AVIATION WEEK

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SEPT. 12, 1955

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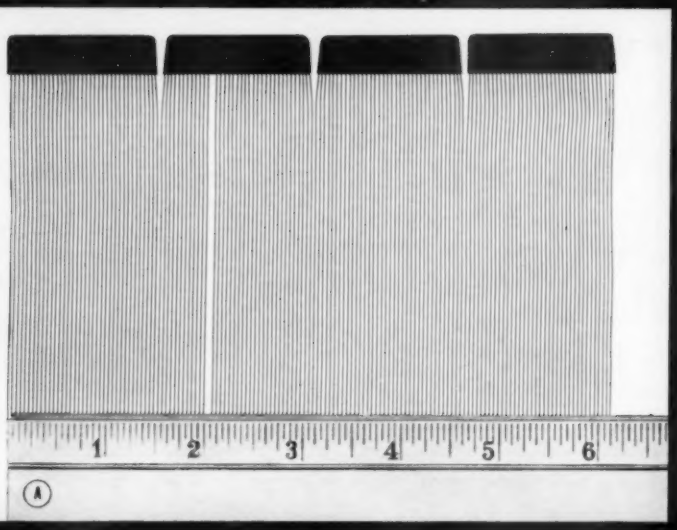

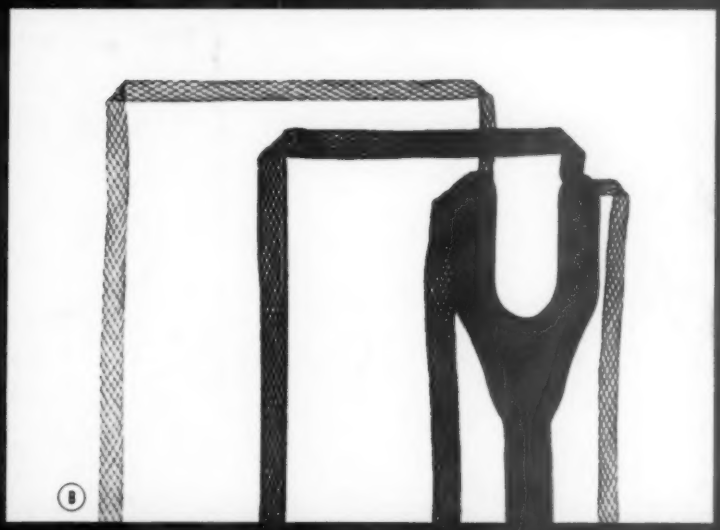

X-RAY VIEWS OF (A) Goodyear Electrothermal System employing embedded resistance wires woven in thin rubber-coated fabric, and (B) Braided leads supplying power to an embedded ply of Goodyear Conductive Rubber.

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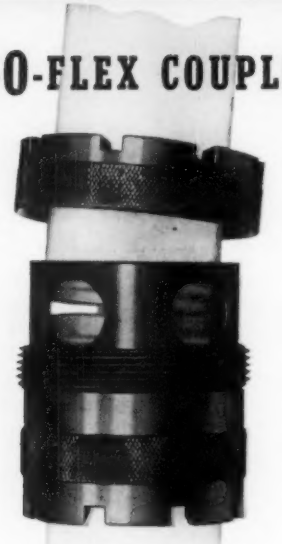
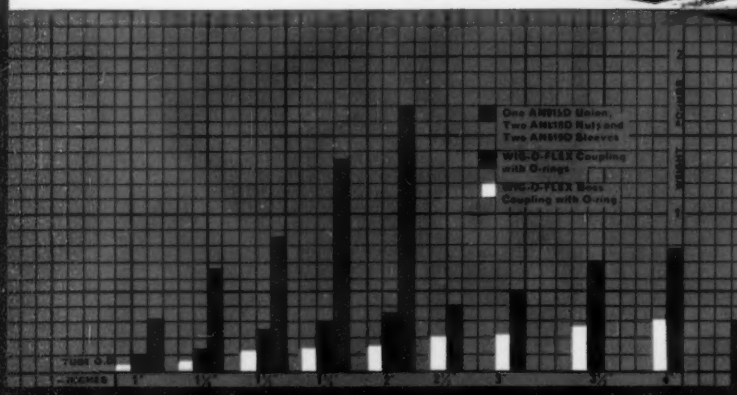
WIG-O-FLEX COUPLING



flexible union for connecting rigid tubes



WEIGHT COMPARISON CHART
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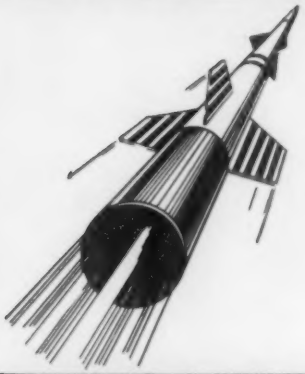

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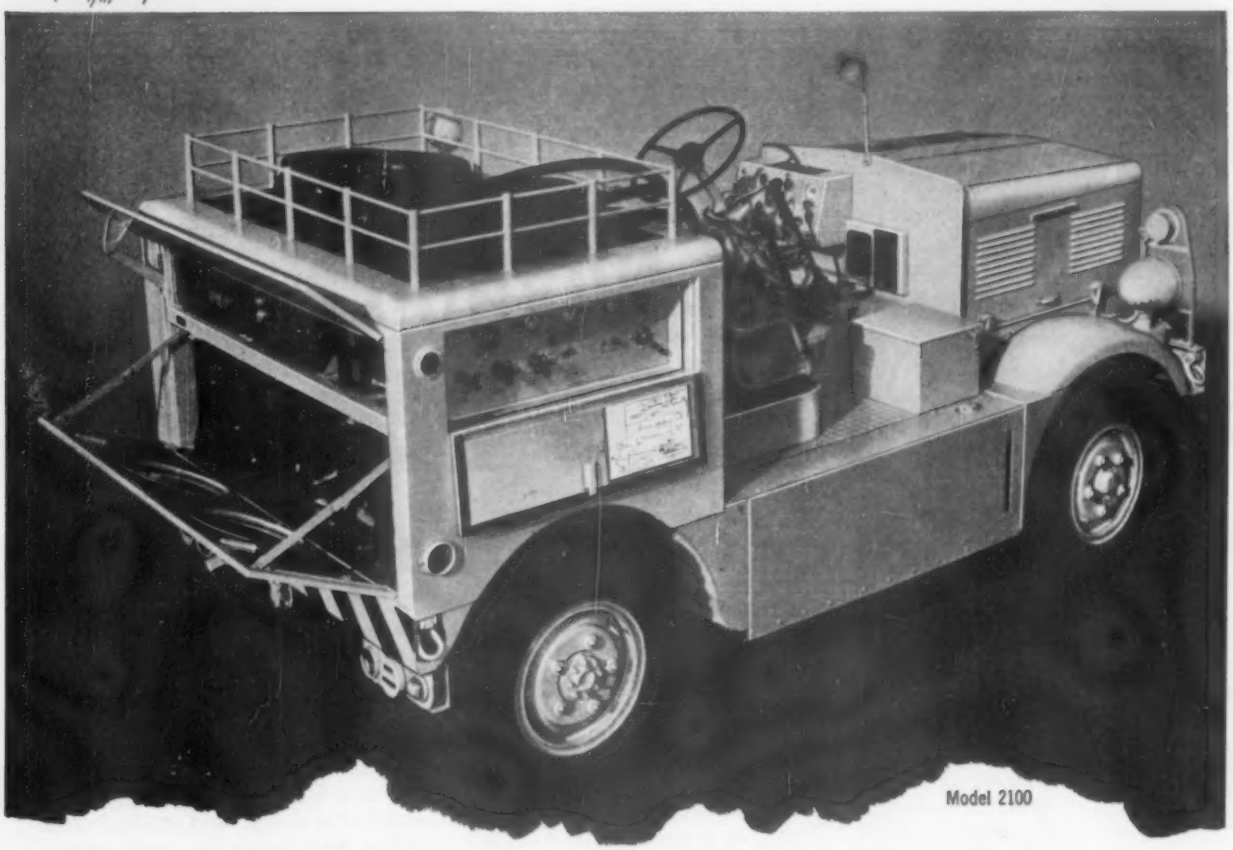

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NORTH AMERICAN AVIATION, INC.

SEPTEMBER 12, 1955

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NEWS DIGEST

Domestic

Jindivik jet target drone probably will be built and sold in the United States by East Coast Aeronautics, Inc., under license from Australian government. The U. S. firm already has signed its end of the contract, but Australian sources in Washington reported last week that their government has not yet approved the agreement. Tentative pre-production plans call for Australia to send East Coast a quantity of the electronically-guided pilotless aircraft for evaluation. Magnesium alloys, developed by the American company, are expected to find wide use in construction of the drone and may improve its performance.

Seven-day strike of 20,000 production workers against Bendix Aviation Corp. was settled Sept. 4. The new contract between Bendix and the United Auto Workers (CIO) guarantees employes 60 to 65% of their regular take-home pay during layoffs, including state unemployment compensation, for up to 26 weeks. The agreement also provides for wage increases of up to six cents an hour and various other fringe benefits.

Twelve Convair 440s were ordered by Sabena Belgian Airlines, bringing the total number of Metropolitans sold so far to 38 (AW Sept. 5, p. 98). Sabena's $9-million contract calls for 44-passenger transports, with removable bulkheads to permit conversion to the 52-seat configuration. Convair President Joseph T. McNarney says other U. S., European and Latin American Metropolitan orders are now under negotiation.

The name Tacan stands for tactical air communication and navigation. Not merely tactical air navigation. The system is expected to be capable of providing air-to-ground and ground-to-air data transmission (data link) and possibly voice communication through pulse-coded modulation.

Pratt & Whitney Aircraft plans to double the production space of its North Haven, Conn., plant. The engine builder expects the addition—500,000 sq. ft. of production floor space and 100,000 sq. ft. of office floor space—to be ready for occupancy by about mid-1956.

Fairchild Engine & Airplane Corp.'s Engine Division received new subcontract orders totaling more than $4.2 million during August. The contracts were for large powerplant components—including turbine wheels, front and rear engine frames and exhaust nozzles.

Conway Jet Starts Tests

Rolls-Royce Conway by-pass engine makes its first flight in the Conway-Ashton testbed aircraft. The 13,000-lb.-thrust British turbojet powerplant is mounted in a pod under the high-altitude research plane's fuselage. The jet and its testbed appeared at Britain's SBAC aircraft show in Farnborough last week (see p. 12).

Storm-warning radar, manufactured by Radio Corporation of America, will be installed on four Douglas DC-7Cs ordered by Swissair. The transports will be delivered to the Swiss airline in 1956.

Beech Aircraft Corp. has started deliveries on a $750,000 subcontract with Lockheed Aircraft Corp. for wings for the T2V-1 Navy jet trainer. Production at Beechcraft's Liberal and Wichita Divisions will extend well into 1956.

Financial

Curtiss-Wright Corp. declared quarterly dividends of 40 cents on common shares and 50 cents on Class A stock, both payable Sept. 28 to holders of record Sept. 7.

International

Morane-Saulnier MS 760 was scheduled to start tests by the Royal Canadian Air Force last week at Montreal. A team of RCAF headquarters and training officers earlier had made preliminary evaluations of the jet trainer at Beech Aircraft Corp.'s Wichita plant. Beech holds an option from Morane-Saulnier on rights to manufacture and sell the MS 760 in North America.

Dornier DO-27, first postwar plane built by the German airframe company, made its first flight at Oberpfaffenhofen near Munich. The single-engine two-place aircraft was constructed in Spain by Dornier engineers and technicians and shipped to Germany for test flights.

Canadair Ltd. and its affiliate, Orenda Engines Ltd., are negotiating a sales agreement with the Venezuelan government for Canadian-built F-86 Sabres. Exports to Venezuela would be the first to a country outside the North Atlantic Treaty Organization for the Canadair fighter and its Orenda turbojet powerplant.

Four Martin B-57s arrived in Japan last week and will be used by the U. S. Air Force for bomber crew training. The lead twin-jet bomber made the 2,410-mile trans-Pacific flight from the U. S. in 5 hr. 45 min.

New international airport will be constructed by the Canadian government near Edmonton, Alta. The field will have at least two 10,000-foot runways. It will be used by Northwest Orient Airlines on flights to Alaska and the Far East.

Linea Aerea Costarricense is being formed in Puerto Rico to provide regional air service in Central America. The airline will start operations Dec. 1 with Convair 340s, flying between the cities of San Juan and San Jose.

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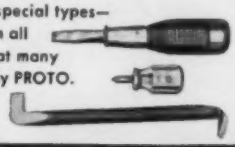

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AVIATION CALENDAR

Sept. 17—Institute of Radio Engineers, Symposium on Automation, Cedar Rapids.

Sept. 17-18—Antique Airplane Assn. Convention and Fly-In, Ottumwa, Iowa.

Sept. 19-21—American Rocket Society, Western Fall Meeting, Los Angeles.

Sept. 21—Southwest Airmotive Engine Forum, sponsored by Pratt & Whitney and Bendix, Melrose Hotel, Dallas.

Sept. 21-22—American Helicopter Society, second West Coast Forum, Hollywood-Roosevelt Hotel, Hollywood, Calif.

Sept. 28-29—American Institute of Electrical Engineers and Institute of Radio Engineers, Park Sheraton Hotel, Detroit.

Sept. 29-30—Radio Technical Commission for Aeronautics, fall assembly, Hotel Statler, Washington, D. C.

Oct. 3-5—Eleventh National Electronics Conference, Hotel Sherman, Chicago.

Oct. 4-6—Eleventh annual Aircraft Spark Plug and Ignition Conference, sponsored by Champion Spark Plug Co., Secor Hotel, Toledo, Ohio.

Oct. 5-7—National Business Aircraft Assn., eighth annual Meeting and Forum, Sheraton-Cadillac Hotel, Detroit.

Oct. 5-7—1955 National Airports Conference, sponsored by American Association of Airport Executives and University of Oklahoma, Norman, Okla.

Oct. 5-9—World Plastics Fair and Exposition, National Guard Armory, Los Angeles.

Oct. 7—Escape from High Performance Aircraft Symposium, sponsored by Institute of Transportation & Traffic Engineering Ext. at U.C.L.A., Aeromedical-Engineering Assn., Institute of the Aeronautical Sciences, IAS Building, Los Angeles.

Oct. 11-14—National Association of State Aviation Officials, annual convention, Dallas.

Oct. 11-15—Society of Automotive Engineers, Golden Anniversary Aeronautic Meeting, Aircraft Production Forum and Aircraft Engineering Display, Hotel Statler, Los Angeles.

Oct. 18-19—Seventh annual Aerial Dusting and Spraying Conference, sponsored by the Washington State Aeronautics Commission and the State College of Washington, Wenatchee, Wash.

Oct. 17-21—National Safety Council, 43rd National Congress and Exposition, La Salle and Conrad Hilton Hotels, Chicago.

Oct. 17-21—International Air Transport Assn., 11th annual general meeting, Waldorf-Astoria Hotel, New York.

Oct. 20-21—Sixth annual National Noise Abatement Symposium, Armour Research Foundation, Chicago.

Oct. 24-25—Institute of Radio Engineers' Professional Group on Electron Devices, first annual Technical Meeting, Shoreham Hotel, Washington, D. C.

Oct. 26-28—Southeastern Airport Managers' Assn., annual meeting, Greenville, S. C.

Oct. 31-Nov. 1—Institute of Radio Engineers, 1955 East Coast Conference on Aeronautical and Navigational Electronics, Lord Baltimore Hotel, Baltimore.

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WHO'S WHERE

In the Front Office

Peter G. Masefield, chief executive of British European Airways, will resign Oct. 31 to become managing director of Bristol Aircraft, Ltd., a new firm being formed by Bristol Aeroplane Co.

Adm. Robert B. Carney (USN Ret.), board of directors of the Fairchild Engine and Airplane Corp. Carney was formerly Chief of Naval Operations, member of the Joint Chiefs of Staff, and Commander of NATO forces.

John Vogeler, engineering consultant, vice president and general manager of Rollins Electronics Corp., Lewes, Del.

A. E. Van Cleve, vice president, Barium Steel Corp. Van Cleve formerly was vice president of Crucible Steel Company.

C. Allen Fee, vice president and secretary of ACF Industries.

David T. Marvel, vice president-sales of the Metals Division, Olin Mathieson Chemical Corp. Other changes: **E. W. Sherman,** sales manager for brass products, **H. F. Devens,** sales manager for roll bond products.

R. S. Reynolds, Jr., chairman of the board, Robertshaw-Fulton Controls Co.

George G. Stier, assistant vice president of the plastics division, Nopco Chemical Co.

Rear Adm. Arthur S. Born (USN, Ret.), assistant to the vice president, research and development, Collins Radio Co.

Clyde P. Barnett, aeronautics director, California Aeronautics Commission.

John J. O'Neil, executive assistant to the director, Cornell Aeronautical Laboratory. Other changes: **John C. Kane,** personnel manager; **Alvin E. Green,** contract manager.

John W. Frazier, staff assistant to the president, Bill Jack Scientific Instrument Co.

Brigadier F. C. Wallace, member of the board, Decca Radar (Canada) Ltd., Toronto. Wallace is president of Canadian Pittsburgh Industries Ltd. and Smith & Stone Ltd. and executive vice president of Duplate Canada Ltd.

Changes

Air Vice-Marshal Joseph Cox, Senior Air Staff Officer, Flying Training Command, Air Ministry, London, England.

J. E. P. Dunning, Director of Engine Research and Development II, Ministry of Supply, England. Also promoted: **R. O. Freeman,** Director of Guided Weapons Production; **R. J. Lees,** Director of Scientific Research on Guided Weapons.

Frederick H. Greene, Jr., chief of promotion and business for Nuclear Energy Dept. of National Research Corp.

Walter J. Hatcher, personnel administration and public relations director, Doman Helicopters Inc.

B. Paul Blaine, assistant director of route development, Washington TWA office.

Elbert Cheyno resigned as assistant to the president of Allegheny Airlines to accept a position with Kindred Aviation.

(*Continued on page 101*)

INDUSTRY OBSERVER

(Editor's Note: This column was prepared by a team of Aviation Week editors who attended the National Aircraft Show in Philadelphia, Pa.)

► New model of the Hughes Aircraft Falcon GAR-98 air-to-air missile will be about 8 lb. heavier than the present missile, and the fuselage will be lengthened. Present missile weighs about 112 lb. USAF is considering plans to equip day fighters with the Falcon.

► **Cause of the X-1A explosion (AW Aug. 15, p. 17) may have been due to failure of seals near the liquid oxygen tank.**

► Aleksi F. Antonov, engineer major, Russia's assistant air attache in Washington, who was an interested spectator at the National Aircraft Show, has 3,750 flight test hours.

► **Major modification of the Piasecki YH-16, present piston-powered version of the 40-passenger Transporter, will be replacement of the 3-bladed rotors with 4-bladed. It is possible that the fuselage will be lengthened to keep the fore and aft rotors from hitting each other.**

► Indicative of the Douglas A4D-1's easy flight handling characteristics is the plane's ability to fly in a level attitude at 90-95 knots at almost any weight.

► **New Westinghouse PD-33, 6,000-lb. thrust private venture turbojet will be flying next spring in a B-45 testbed. A steel version of the engine already has undergone a 50-hr. trial, and the combustor section reportedly has been lab-tested successfully at simulated altitude of 95,000 ft. The PD-33's single compressor has 16 stages and uses an airflow pattern similar to that of a late-model Rolls-Royce Avon. Westinghouse has license and information interchange agreements with Rolls-Royce. Engine also features two gear boxes for accessories; a small one under the inlet which is connected by a shaft to a larger one under the narrower waist section of the powerplant.**

► Michael Stroukoff, president and chief engineer of Stroukoff Aircraft Corp., W. Trenton, N. J., says he is working on a new transport that is larger than the Chase-Fairchild C-123. He also has a small transport design in work.

► **Among the simplified equipment installed in the lightweight Douglas A4D-1 Skyhawk is a single-face engine instrument which displays all of the necessary information on the Wright J65, obviating need for the pilot to scan several dials.**

► Grumman F11F-1 Tiger supersonic fighter is reported to be suffering from buffeting at comparatively low speeds.

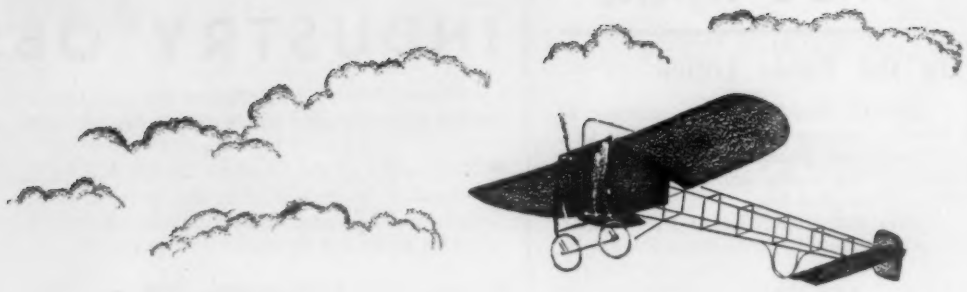
► **Industry sources report that USAF fighter designations have gone at least as high as F-113.**

► Bell Aircraft's jet VTOL has made several transitions from vertical to horizontal flight.

► **Piasecki Helicopter Corp. has reduced subcontracting on the H-21 from 70 to 25%.**

► Most of air-to-air refueling flying boom installed on new Boeing KC-135 jet tanker will be retracted into the plane's tail, providing much cleaner installation than present booms on KC-97 Stratofreighters.

► **North American F-100Cs in the Bendix Trophy cross-country race carried 1,750 gal. of fuel. Planes can carry an additional 230 gal. in each of two underwing auxiliary tanks. Super Sabres in the race didn't carry the drop tanks. Replacement of braking chutes at fueling stops took approximately 90 seconds.**



You CAN Afford Travel Safety

Aunt Mehitabel's ideas about "flying machines" are as outmoded as her hats

Modern personal and executive airplanes have a safety record that is superior to that of motor cars *by a ratio of about five to one.*

No one who has experienced the pleasure of flying straight to his destination in a BEECHCRAFT at a speed of from 180 to 215 miles per hour will be content to fight traffic at 40 or 50 miles per hour on the ground, around devious routes.

The cost of a Bonanza is greater than a top-grade car, but it delivers more miles per gallon, and owners often depreciate it over 500,000 miles of use. If usage is reasonably high, the cost per mile is very little more than that of a fine motor car.

You *really can* afford travel safety. For complete details, see your BEECHCRAFT dealer or distributor, or write to Beech Aircraft Corporation, Wichita, Kansas.

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BEECHCRAFTS ARE THE AIR FLEET OF AMERICAN BUSINESS

Washington Roundup

Politics and Air Power

Political interference with planned Fiscal 1956 expenditures for national defense last week menaced the U.S. Air Force, but informed Pentagon observers believed the threat could be beaten off.

Reports that the Defense Department had been ordered to slash about $1 billion from its Fiscal 1956 expenditures (AW Sept. 5, p. 11) were confirmed in easier language. A Defense spokesman said no top limit had been set but "exercises" are being held to explore the possibility of getting the overall department expenditure down to $33 billion. To do this, it was indicated, USAF would have to absorb about $750 million of the reduction.

Political angles of the situation held topmost interest:

• **Goal of a balanced Fiscal 1956 budget** is the prime concern, not of the White House staff, but of its GOP advisors, who feel they need it as a form of election insurance in case President Eisenhower decides not to run for another term.

• **The White House favors a balanced budget** but not at the expense of weakened national defense. The attitude here is that a substantial part of the American people, shocked by Russia's air power demonstration in May and first reported by AVIATION WEEK (May 23, p. 12), prefers a strong USAF to a balanced budget.

• **The internal political conflict,** if it develops, will be between Treasury Secretary George Humphrey, who is strongly conscious of political problems, and Defense Secretary Charles E. Wilson, who has gone before Congress as recently as mid-June to seek more money to accelerate B-52 production. Deacceleration at this time would be similar to the Louis Johnson "stretch-out" before the days of Korea, a program that was fatal to Johnson's career and reputation.

• **Close as Wilson has been to Humphrey,** the Defense chief in recent months has, of his own admission, learned much about the importance of Congressmen. Top threat here is Sen. Stuart Symington, Missouri Democrat, and former Secretary of the Air Force. Wilson knows that any threat to air power will subject him to a devastating attack on Capitol Hill. Only unknown quantity: will the Democrats open fire at once when and if cuts are made, or silence their guns until the political campaign is under way?

USAF Secretary Donald A. Quarles paid a flying visit to Wilson at a Michigan vacation spot to discuss the situation. Presumably, he carried with him details of where USAF would have to cut if the GOP request is met.

Less than a week before Quarles was briefed on this subject in a two-day session with his top financial and procurement advisors.

At the Pentagon, it was reported that Quarles "will not scream until he knows he has been hurt" but it was clear that he is "ready to scream if necessary."

USAF's plans call for expenditure of about $5 billion for aircraft in Fiscal 1956. There is no doubt that the politically-minded economy advocates would like to reduce this figure.

While Secretary Quarles withheld comment, he gave a clue to his attitude in a speech at Philadelphia before the foreign air attaches.

He said: "President Eisenhower is bending every effort of his Administration toward achieving a proper balance between the requirements of military preparedness and the long range requirements of national economy and welfare . . .

"We are proceeding on the assumption . . . that the American people want an Air Force strong enough to accomplish its mission . . . Our objective must be to get the most value for the dollars we spend. This means not only that we must continue to practice good management within the Air Force, but even more important, that we maintain a steady program which will give the aircraft and electronics industries which serve us an opportunity to provide the equipment we need on an orderly basis without costly crash expansions or sharp cutbacks."

New CAB Atmosphere

Recent Civil Aeronautics Board handling of major route cases gives evidence of some shifts in its approach to route regulation. Action of the Board in the New York-Chicago case (see p. 13) and of examiners in the Northeast-Southwest and Denver Service Cases, shows a trend toward a gradual overhaul of the present trunkline route structure. With the Big Four continuing to expand its dominance, CAB appears inclined to strengthen the smaller trunks in their various areas to improve their economic position and make them more effective competitors.

Capital Airlines and Northwest Airlines became the first beneficiaries of the new atmosphere with substantial gains from the New York-Chicago decision. Adjustments in Capital's system are so extensive that they approach the value of new route awards and will result in a substantially stronger route structure for the regional carrier.

Shakeup in Navy?

Watch for major shakeup in Navy public information soon after Rear Adm. Edmund B. Taylor takes over. His superior, Adm. Arleigh Burke, new Chief of Naval Operations, is deeply conscious of present and past weaknesses and is determined to remedy them. Himself a victim of Navy policy in the days when Op-23, which should have been explained to the public, was kept secret and therefore sinister, Adm. Burke is not without experience in the damage that can be done by stupidity in public relations. An interested spectator at the National Aircraft Show, Adm. Burke had an opportunity to see his present publicists in action. Biggest asset to the Navy PIO setup in Philadelphia was Cmdr. Cook Cleland, 1947 and 1949 winner of the Thompson Trophy, who is back in service, and the best-informed Navy PIO at the show.

Surface Mail By Air

General Accounting Office has completed an audit showing that Post Office Department's experiments in the shipment of regular mail by air have been profit operations. Sen. Styles Bridges (R.-N. H.), though, has ordered a re-check.

Meanwhile, the staff of House Post Office Committee is making a study of the pros and cons of permanently authorizing the air shipment of regular mail when space is available. This would require legislation. Vincent Burke, Deputy Postmaster General in the Truman Administration, has been retained as a committee consultant.

—Washington staff

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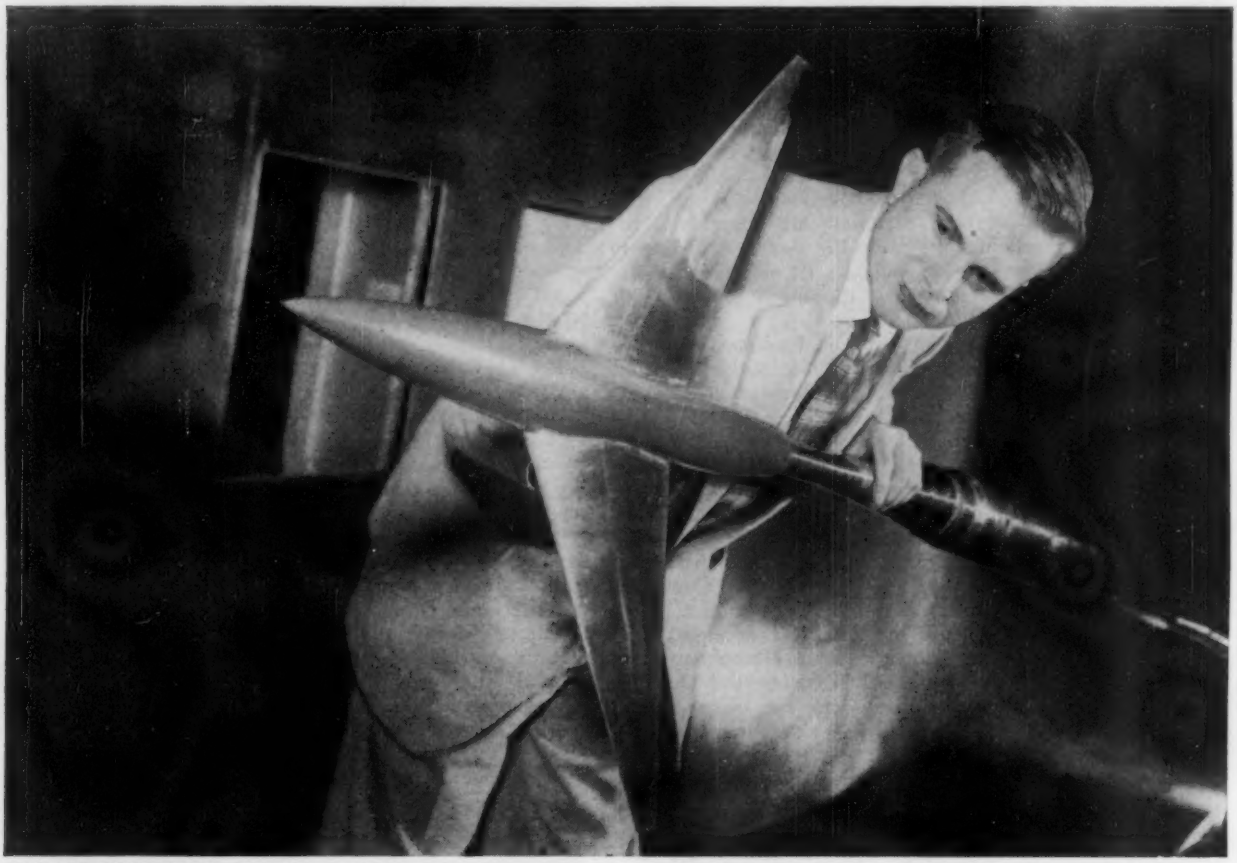


RICHARD WHITCOMB, who discovered the area rule concept, with one of the wing-body combination models that verified his theory.

NACA Formula Eases Supersonic Flight

By David A. Anderton

Washington—A revolutionary concept in supersonic aircraft design that is increasing speeds of U. S. military aircraft by as much as 25% was revealed today by the National Advisory Committee for Aeronautics.

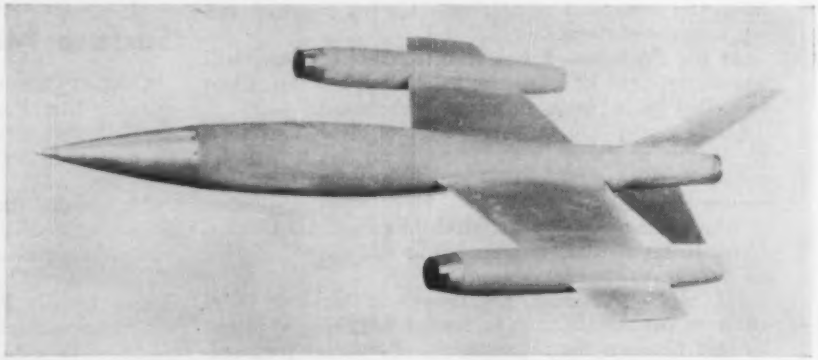
Known as the area rule and developed by Richard T. Whitcomb of NACA's Langley Aeronautical Laboratory, this concept reduces the once-complicated procedure for determining minimum aircraft drag configuration to a simple graphical procedure.

The NACA area rule has been dramatically confirmed in supersonic flight testing of the following new fighters:

- **Convair F-102A Delta** all-weather interceptor now in production for USAF at San Diego.
- **Grumman F11F-1** carrier-based interceptor now in production for the Navy at Bethpage and Peconic River, Long Island.
- **Chance Vought F8U-1** carrier-based interceptor scheduled to go into production soon at Dallas, Tex.

The area rule was discovered by Whitcomb and his co-workers in the NACA eight-ft. transonic tunnel at Langley Field during 1951 and later verified by rocket-powered model tests at NACA's Pilotless Aircraft Research Station at Wallops Island, Va. Area rule data was made available to the aircraft industry in 1952 on a secret basis. The first prototype aircraft incorporating it flew during 1954. Area rule data was kept under tight military security until today—nearly 21 months after AVIATION WEEK first learned of the concept.

Whitcomb's concept says that basi-



MODEL of hypothetical plane using area rule to compensate for interference drag.

Area Rule and Coke Bottle

It's unfortunate that the phrase "Coke Bottle" was given to the fuselage shape derived from the Whitcomb area rule, because the two are not the same.

During World War 2, the German aerodynamicist Kuchemann made flow studies over the wing root of a swept-back wing and fuselage combination. He found that the flow turned in toward the fuselage, then turned out again; his reasoning was that the interference of wing and fuselage at the root would be minimized if the fuselage were contoured to match the flow.

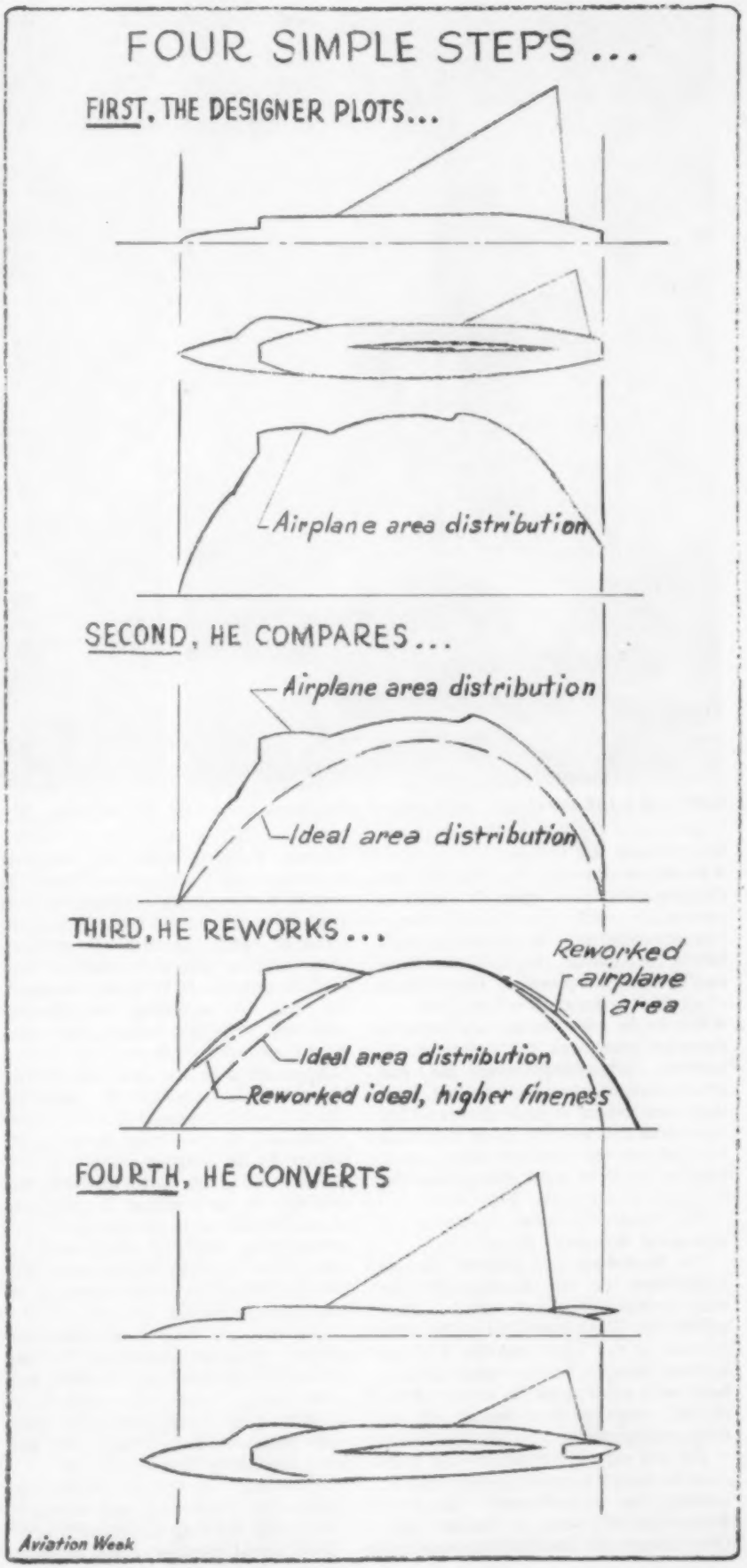
American intelligence teams discovered the development and tagged it with the name of "Kuchemann Coke-Bottle."

As far as is known, Kuchemann did not extend his ideas to any other wing form than the swept; Whitcomb's area rule applies to any general shape. While the two applications on a swept wing can look alike, in reality they differ because Kuchemann's is tailored to the local streamlines of flow and Whitcomb's is contoured to maintain an area equivalence based on the entire stream tube.

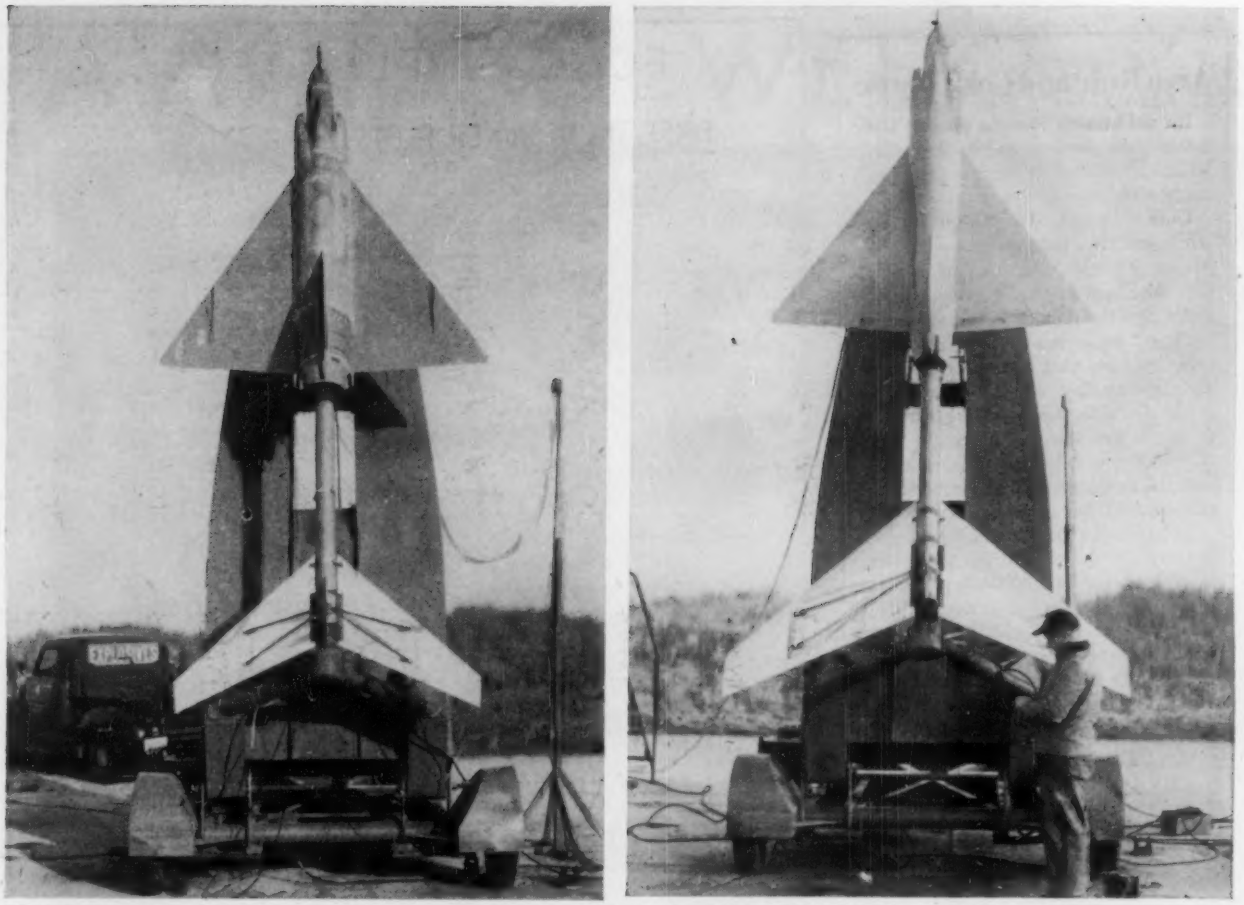
cally the interference drag—the major drag component at transonic speed—depends almost entirely on the distribution of the airplane's total cross-sectional area along the direction of flight. Interference drag is caused by the interaction of wings, fuselage, tail and other airplane components. To combat this Whitcomb found that the lowest drag in the transonic range was recorded for a theoretically optimum body of revolution—a streamlined shape that resembled bombs without fins. The next step was the discovery that drag in this speed range decreased in proportion to how closely the cross-sectional area of a winged body resembled that of the optimum body of revolution.

The four steps confronting a designer in applying the area rule to a new aircraft are:

- **First, the designer plots** the cross-section areas of his first layouts against the overall lengths.
- **Second, he compares the shape** of those curves with the area distributions for an "ideal" shaped body of revolution. The "ideal" shapes have been derived mathematically; one recent NACA Technical Note (TN 3478: On Boattail Bodies of Revolution Having Minimum Wave Drag; by Keith C. Harder and Conrad Rennemann, Jr., LMAL) gives some specific shapes. The slimness—or fineness ratio—is limited by design considerations. Grumman's Tiger was length-limited by carrier elevator dimensions; its diameter of the Tiger was determined by size of the



area change from nose to tail of a section with the circumference outside 60 percent. For a swept wing, the



CONVAIR F-102 model (left) in its original aerodynamic guise ready for launching. Modified version (right) resulting from area rule.

Wright-built J65 turbojet.

• **Third, he reworks** the airplane area distribution until it agrees as closely as practicable with the "ideal" shape. Compromises may be forced by such factors as visibility requirements from the cockpit, or provision for addition of an afterburner at some later date.

• **Fourth, he converts** the new area distribution plot back to airplane cross-sections, subtracting wing, tail and other component areas from the fuselage cross-section at each station. That area reduction may be made by a uniform change in fuselage radius, or it may be made by local changes on the fuselage side, as in the Tiger.

The result: an optimum layout for minimum transonic drag.

The final shape can show the curious indentation of the fuselage at the wing which has erroneously been called the "Coke bottle," familiar now because of the Tiger and the F-102A. In both designs, fuselage cross-sections have been reduced locally in the region of the wing by the amount of the wing cross-sections.

But it's not always necessary to take away area—and therefore usable volume—from the space-limited designer. Sometimes, it's necessary to add area. One example is: The tail blister on the Convair F-102A, added by scientists at Wright Air Development Center as part of the major fix required for that airplane to fill in the area diagram to make it match the ideal shape more closely. The extended nose of the F-102A and the F11F-1 also improves the drag by increasing the fineness ratio and as a side benefit, they produce more useful volume.

Application of the area rule to the Vought F8U resulted in gains of valuable volume around and aft of the powerplant, a space used to great advantage by the designer.

That's all there is to applying the area rule to an airplane for the case of zero-lift drag at transonic speed. But behind this simple plotting stretches a long line of ideas, calculations and tests firmly tied to the development of the transonic tunnel.

The area rule, like many othe aeronautical advances, originated in one of NACA's fundamental research programs. No goal was set up; instead, the scientists were merely curious to know what transonic flow looked like and how transonic drag was produced.

What was the shock pattern on simple wing shapes and body forms?

Why did the drag rise occur?

How could airplane drags be computed; could component drags simply be added together?

The answers had to wait for the availability of the transonic tunnel.

This unique tool was developed by John Stack, Assistant Director of Langley, and won for him the Collier Trophy for 1951. Whitcomb directed this study, which included many pressure distributions and Schlieren photographs.

The Schlierens were startling; they showed the existence of a strong normal shock behind the trailing edge of the wing-fuselage intersection, in addition to the normal shock near the nose. This shock extended way out into the stream so that its geometry was large compared to the size of the wing-body combination. This was Whitcomb's first clue: The transonic drag rise was caused by losses from that shock.

Other clues followed from the study of the results of the first test. The shock formations and the drag rise at zero lift for the wing-body were similar to the expected shape of shocks around a modified body of revolution. That body had a swelling around its middle, like the egg sack of an earthworm; the swelling represented the additional cross-sectional area of a wing, wrapped uniformly around the body. Thus, the

area change from nose to tail of a wing-body combination was duplicated from the nose to tail by the comparable body of revolution.

While those results were being studied, a different series of tests was being made in the transonic tunnel. It was planned to evaluate the magnitude of the transonic interference drag, and the tests were made with swept, unswept and delta wings plus bodies with differing curvature at the wing.

This set of tests showed three major facts about interference drag:

• **Wing-fuselage interference effects** are greatest at transonic speed and may be as large as the wing drag alone.

• **Fuselage shape changes**—even small ones—produced large variations in wing and interference drag.

• **Wing-body combinations** must be treated as an aerodynamic system with the component drags mutually dependent. Total drag can't be computed by simple addition of the drags of wing, fuselage, tail and other items.

With these conclusions and those of his own studies as a basis, Whitcomb reasoned that the interference drag was the source of the largest portion of the transonic drag rise. Reduce the interference drag, and the transonic rise is hewn, not whittled, down. Then he went back to the flow studies for a second look at transonic flow.

Flow Review

This is the point at which Whitcomb had to "see" the air in order to better understand its flow patterns. Others before him had tried a similar attack on the drag problem; one had an answer within his grasp, but concluded that there was no practical value in pursuing the idea any further. Perhaps the others never grasped completely the transonic flow picture because their approaches were mathematical. They tried to analyze the flow without also visualizing what happened.

The aerodynamicist works with differential volumes of air, with streamlines and with stream tubes. The differential volume is, as the name indicates, an infinitesimally small unit of air. It moves along a flow line called a streamline. If nothing disturbs it, the streamline is straight. If the air flows around a wing or body, the streamline curves, displaced by the intrusion of the surface in its path.

A bundle of these streamlines is called a stream tube. A common approach to the theoretical analysis of airflow problems is to isolate a stream tube which contains the object under study.

That's what Whitcomb did; he visualized two stream tubes. One contained the wing-body combination he had been studying; the other held a comparable body of revolution.

He chose to observe at a circular section, with the circumference outside the wingtips of the wing-body combination. Then he mentally looked at the flow from station to station along the length of the bodies. First, the streamlines deviated around the nose, then along the cylindrical body, and over the wing or the middle bump. Then the streamlines closed down again over the rear of the body and eventually came back to the normal path downstream. All this variation from the straight line pattern of streamlines produces flow distortions in any plane normal to the centerline of the body. But two factors work to smooth out these distortions rapidly.

• **Pressure changes along the circumference** of any stream tube at any plane normal to the centerline. These changes, caused by the relative speeds of adjacent streamlines distorted by the surface, tend to smooth out the bumps quickly by influencing the flow, around the circumference.

• **Rigidity of the outer streamtubes** acting like the walls of a wind tunnel, these outer streamlines resist displacement, and consequently tend to smooth out radial deviations in the flow.

Both the circumferential and the radial flow changes are quickly lost as the flow gets away from the immediate vicinity of the body. Whitcomb found that the two kinds of flow—over the wing-body and over the equivalent body—were almost identical at only a short distance from the body.

This was the basis for the area rule. In March, 1952, shortly after determining the rule, Whitcomb presented his whole program to the Langley Laboratory's research department. He had no proof of his ideas, but the research group agreed with his conjectures with few reservations. They suggested experimental verification.

Tests of simple wing-body combinations and their equivalent bodies began in April. By this time, Whitcomb had postulated a corollary to his original theorem of area equivalence. The corollary said, in effect, that a wing-body combination could be made to have the same area distribution as a a minimum-drag ideal body, and would therefore have minimum drag. Doing this was simple: The body was merely robbed of enough of its cross-section area to compensate for the extra area added by the wing. This produced an indented body.

The tests were the final proof; all Whitcomb's reasoning was justified in the pressure distributions, Schlieren photographs and drag curves that came out of the transonic tunnel. From now on, the wing could get a free ride.

The magnitude of the drag saving was enormous. For an unswept triangular wing and for a delta wing, the drag rise of the wing was reduced by 60 percent. For a swept wing, the drag rise was eliminated completely at Mach numbers up to 1.04. Above that mark, the effect of the indentations wore off for zero-lift conditions.

Two Airplanes

By August 1952, things looked black for the Convair F-102. Intended as a supersonic airplane, it was stuck at Mach .9. There were rumors that USAF would cancel the contract.

Transonic tests at NACA's 8-ft. tunnel showed the drag hump at sonic speed was above the capability of the airplane. Convair and Langley engineers met at Langley and decided that salvation lay in the area rule. The Convair engineers returned to San Diego, taking their model for rework.

In October, a delegation from Grumman came down, wanting to know more about the area rule. They were coming up with a new fighter on which a lot of Grumman's future was riding. By February 1953, they had made layouts for Design 98, Grumman's designation for the F9F-9, later to be called the F11F-1. Whitcomb visited Grumman and helped work out the Tiger's final lines.

Right after this, a modified model of Convair's F-102 went into the transonic tunnel for evaluation, and again Whitcomb made the trek to a manufacturer to discuss final lines with the engineers. By July 1953, the layout of the F-102A was completed.

In the meantime, the transonic tunnel had been busy testing the Grumman Design 98 model. The results were good; the Tiger was going to have relatively low transonic drag. By August the tests were completed.

Two months later, the F-102A tests had ended. The final results said what Convair engineers wanted to hear: The airplane would be supersonic. All that was necessary now were the flight tests.

As it happened, Grumman got there first. One year after the tests in the tunnel had stopped, the flashy white Tiger breezed through sonic speed in level flight without the use of an afterburner, the first time this had been done. Grumman pilot C. H. "Corky" Meyer handled the flights and the impressive public demonstration of the Tiger (AW Aug. 16, 1954, p. 381) which followed after the first test runs.

A few months later Convair's Richard L. Johnson flew the F-102A out of Edwards AFB and went past Mach 1 while still climbing.

Other designs have since followed, their bodies indented or bulged by the area rule for better performance. New bomber designs are also using the area rule.

Whitcomb's brilliant conjecture and thoughtful experiments are paying off in a dramatic way in the performance of the next generation of fighting planes.

FAIREY F.D.2, stated to be Britain's most advanced research plane, shows 60-deg. sweep on leading edges of its delta wings.

Farnborough Shows British Design Lag

By Staff Correspondent

Farnborough, England—The future promise of two turbojets—the Rolls-Royce Conway and the de Havilland Gyron—was the brightest spot in the otherwise dullest Society of British Aircraft Constructors display since 1950.

There were no basically new aircraft designs to demonstrate, no large production quantities of in-service airplanes to point to, no hidden surprise leading to brilliantly-conceived future types. More than any other display before it, this 16th SBAC show underscored one fact: in Britain, powerplants are technically well ahead of the airframes required to fly them.

The Conway, type-tested at a 13,000-lb. thrust figure which is well below its capabilities, was flown in an Avro Ashton testbed and shown on the Rolls-Royce stand.

A frantic effort against time got the DH Gyron through its first type test at 15,000-lb. in time to make the announcement just before the display. The test was completed about ten days ago at a figure of 15,000 lb., which is also below its potential. Other test Gyrons have run at thrusts as high as 18,000 lb., to put that engine in a class only with the Pratt & Whitney J75 and the big Russian turbojets that power the Badger and Bison bombers.

The pilots, as always, provided the sparkle.

Squadron Leader E. A. Tennant, Folland's chief test pilot, flung the Gnat around the sky at the full thrust of its Bristol Orpheus engine. Working within the area limits of the airfield, Tennant showed the startling performance of the tiny blue fighter in a rocketing upward zoom after a flat run that was as fast as anything seen at this year's show.

Avro's Roland Falk, flying the second production Avro Vulcan delta-winged bomber, pulled up into a steep climb after a fast run and rolled the huge plane. He followed this with a low-speed run; the Vulcan drifted along, its engines cut back, at perhaps less than 150 mph.

Jan Zurakowski, aerobatic specialist who invented the cartwheel with a Gloster Meteor, hauled the Avro CF-100 up into a stall, spun it for half a dozen turns, climbed for altitude again and did a falling leaf to a low-altitude pull out.

No Surprises

But most of the show was routine. There were the flying engine testbeds—Conway Ashton, Eland Ambassador, Gyron Sperrin, Olympus Canberra—to emphasize Britain's lack of high altitude, high-capacity engine test cells.

There were high-speed passes by the Hawker Hunter, modified to a two-seat layout pointing to an all-weather fighter, the Swift modified to a low-level photo reconnaisance plane, the DH-100 modified to naval requirements.

These modifications and the many minor aerodynamic changes visibly underscored the lack of highspeed and transonic wind tunnels and the almost complete reliance of the British industry on flight testing to prove out minor configuration changes in design.

English Electric's P.1 supersonic interceptor prototype and the Fairey delta-winged F.D.2 research plane were the white hopes of the airframe designers. The P.1, arriving late for the first day, made a flat out run over the field before landing; but by that time, almost everyone had long since departed for home.

R. P. Beaumont, English Electric's chief test pilot who had a narrow escape a few days before the show when the P.1 canopy blew off, proved the amazing maneuverability of the P.1 at low levels.

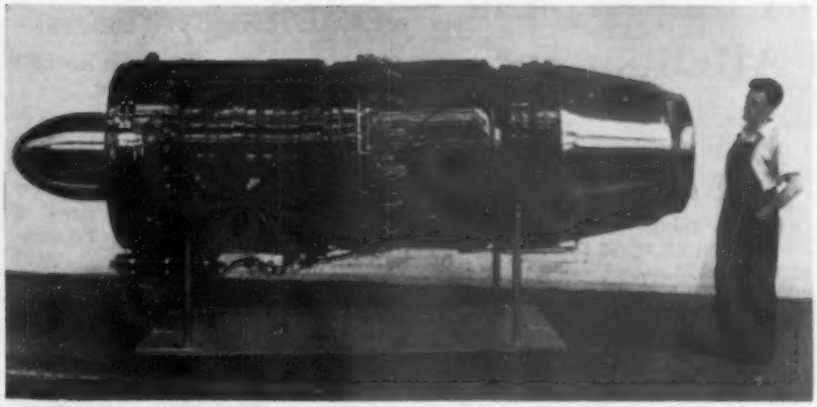
RAF Joins Show

Fairey's F.D.2 roared by at obviously reduced speed during the flights but showed in its thin wing and needle nose layout the promise of an excellent future fighter–interceptor.

To take some of the sting out of the bitter criticism of its equipment, the RAF made a major effort during the display with a mass flyby of grouped Vickers Valiants and Hunters. Twelve Valiants from 138 Squadron streamed by in pairs at a majestic 287 mph. Three formations of 16 Hunters each roared overhead from no less than eight squadrons of the Fighter Command.

Highpoint in the RAF demonstra-

Air Show Move to Philadelphia



POWERFUL NEW DH GYRON turbojet has produced up to 18,000 lb. thrust during tests.

tion was the Hunter aerobatic team from 54 Squadron, led by Captain Richard G. Immig, USAF exchange pilot.

Powerplants Dominate

The exhibition tent was dominated by powerplants. On the de Havilland stand, the great bulk of the Gyron dwarfed every other engine in the show. Short and fat for an axial-flow engine, the Gyron is designed to the supersonic formula with few compressor stages. Bristol's Olympus engine, which a few days before the show thrust the Olympus-Canberra to a new official altitude record of 65,876 feet, is running at still higher thrust than the official type tested and announced figure of 11,000 lb.

In contrast to the clean concept of the twin spool Olympus was a magnificent cutaway model of the Proteus turboprop, with twisted and tortured passages for the air, a holdover from the design requirements for the Bistol Brabazon airliner. Napier, one of the most under-rated engine companies in the business, showed its Oryx gas generator and Eland turboprop, both to be used in large helicopters. The company announced its Gazelle gas turbines, slated to power a Bristol twin rotor helicopter, with 1,260 shp.

Missile Dearth

Missiles were conspicuous by their absence. Only two or three test vehicles were shown on the first day, and there were rumors that one of these would have to be withdrawn for reasons of security. None showed anything of a new or different nature; all were obviously ancient test vehicles painted to look newer than their years.

These impressions remain:

• **Noise of the jet Gyrodyne,** Fairey's testbed for an ultimate transport convertiplane with jet-driven rotors. Sounding like a slow-chugging steam locomotive, the Gyrodyne directly overhead makes a hideous amount of noise, painful to the ears.

• **Sprightly performance of the Widgeon,** converted Westland-Sikorsky's S-51 helicopter demonstrator. The Widgeon was banked steeply and rapidly at low altitudes in one of the better demonstrations of the flight versatility of a rotary-wing craft.

• **Formation takeoff by four Short Seamews,** three abreast and one trailing, their Armstrong Siddeley Mamba power plants whining like a hive of angry bees. Airborne at low speed, these simple, functional anti-submarine aircraft showed off a large speed range and short landing and takeoff rolls.

• **Rocketing climb of the Gnat,** pulled vertical, shooting up, its bright blue vivid against the dull grey clouds.

• **Speed and agility of the jet Provost,** basic and ugly jet trainer developed by Hunting Percival from the Provost piston-engined trainer standard in the RAF.

• **Richard Wheldon,** an excellent arcobatic pilot, showed the capability of this simple airplane with fast passes and tight turns.

Reactions to the entire SBAC display were surprising. British newspapers, usually crowded with nothing but praise for the "world's best aircraft" had been lambasting the industry for weeks before Farnborough. Air Chief Marshal Sir Philip Joubert, quoted in a lengthy newspaper interview, said the Hunter and the Valiant still were in trouble. Joubert placed the blame on "the vast ganglion" of the Ministry of Supply and said that research and development should be taken from them and placed again under the Air Ministry. It was that organization, he said, that produced the Hurricane and Spitfire.

J. J. Parkes, president of SBAC, told that organization's annual dinner that Britain needed now to concentrate on development, not on production.

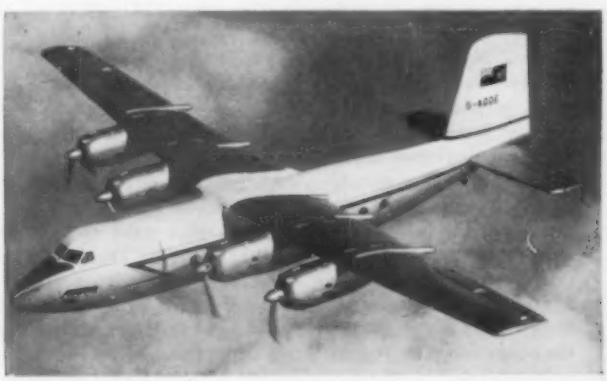
Praise Absent

The day after the rehearsal, traditionally the time to praise the performance, produced only lukewarm comment in the British press. To an American observer, this display was both disappointing and sad.

It was disappointing because of the obvious lack of current applications of advanced research ideas. Most of the airplanes this year were the same as last year and the year before.

It was sad, because Britain has contributed so much to air power in the past, but now she seemed to have touched bottom. Only the excellence of her engines stands out above the low level of airframe development. These outstanding powerplants still are shackled to mediocre airframes, flying testbeds and static test stands.

SCOTTISH Aviation Twin Pioneer uses small airports.



HANDLEY PAGE Herald is new 44-place four-engine feedliner.

Air Show Move to Philadelphia Results in Record Attendance

Philadelphia—Record-breaking attendance of 289,880 and a perfect safety record at the 1955 National Aircraft Show last week justified Defense Department's insistence that the spectacle be moved to a new city with emphasis on the progress of America's air strength.

Unlike recent shows in Dayton and Cleveland, Ohio, this year's static and flying exhibits resulted in no critical undertones from either military or aircraft industry representatives.

An important factor in this was the opportunity given U. S. Navy, an openly reluctant participant, to play host to 28,000 visitors aboard the carrier Ticonderoga, moored adjacent to Philadelphia International Airport. Navy's flying show included catapault launching of the McDonnell F2H Banshee and Chance Vought, F7U Cutlass jet fighters. Silhouetted against the sky above the Delaware River, takeoffs were visible from the stands.

U. S. Air Force's weather limitation of a 2,500 ft. ceiling and five miles visibility forced cancellation of the USAF flying demonstration on the opening day of the show. Flyby of the McDonnell F-101 Voodoo and Lockheed C-130 Hercules turboprop transport as well as a long list of fighters, bombers and transports shown in previous years clearly impressed the Philadelphia crowd on the other two days.

'Report to the Taxpayer'

Fastest flyby in air show history was staged on Labor Day by Col. Horace A. Hanes, winner of the Thompson Trophy, who streaked past the stand at near-sonic speed. To win the prize he had set a record of 822.135 mph over a measured course in Palmdale, Calif., flying the North American F-100C.

All USAF static exhibits of aircraft carried price tags, carrying out the Air Force effort to make the show a "Report to the Taxpayer." In addition, the USAF script for the flying show contained complete information on the price of each participating plane.

In a speech before the foreign air attaches on the eve of the show, Donald A. Quarles, new Air Force Secretary, indicated that his office views the air show as a regular exercise.

"This show is designed," he said, "as an annual report to the American people on the status of American airpower . . . whatever your political beliefs, I am confident that the demonstrations you will see . . . can serve to promote the cause of world peace, if seen in their true perspective."

1956 Location Not Set

Industry comment on the 1955 show was uniformly favorable. Shift to Philadelphia and a new East Coast audience brought out larger and more elaborate exhibits. Perimeter parking was used, with bus service to the airport, speeding movement of the crowd and keeping congestion at a minimum.

Fred C. Crawford, board chairman of Thompson Products and show president, said no decision will be reached on the location of the 1956 exhibit pending conferences with the Defense Department. The show management says invitations have been received from Minneapolis, Chicago, Ft. Worth and two West Coast cities.

At the Pentagon it was reported that the Defense Department first must decide whether or not military participation will be sanctioned next year. It was expected that the 1954 debate will be resumed over the relative merits of the National Aircraft Show compared with more elaborate Armed Forces Day programs and a television presentation of the air power story.

Other exhibition highlights:

- **U.S. Army Aviation** units repeated most of their 1954 presentation with the exception that this year's show featured the Piasecki H-21C Work Horse. Army show was climaxed by "Little Peachy," a simulated atomic burst that mushrooms 400 feet.
- **U.S. Marines** demonstrated an HRS-2 helicopter equipped with rocket-on-rotor (ROR) engines to increase takeoff and lift performance.
- **Army's 509th Helicopter Company**, Ft. Belvoir, Va., received a citation from Army Under Secretary Charles C. Finucane, awarded for the unit's work flying 189 hours on rescue missions during the recent floods in the Northeast states.

Air Trophy Winners

Winners of major events at the 1955 National Aircraft Show include:

- **Thompson Trophy, to Col. Horace A. Hanes, director of the USAF Flight Test Center at Edwards AFB, Calif., for flying a North American F-100C Super Sabre to a new world speed record of 822.135 mph. Mark was set at Palmdale, Calif., Aug. 20.**
- **Bendix Trophy, to Col. Carlos M. Talbott, USAF, of the Tactical Air Command's 450th Fighter-Day Wing, Foster AFB, Tex., who won over five other pilots in a speed run from George AFB, Calif., to Philadelphia, a distance of 2,324 miles. Talbott's average air speed in his F-100C was 610.726 mph.**
- **General Electric Trophy, to the Strategic Air Command's 320th bomb wing, March AFB, Calif. A crew headed by Maj. Leonard J. Stevens flying a Boeing B-47 Stratojet medium bomber flew to Philadelphia from March AFB, 2,337 miles, at an average speed of 589.294 mph. They defeated B-47 crews from the 26th Strategic Reconnaissance Wing, Lockbourne AFB, Ohio, and the 306th Bomb Wing, MacDill AFB, Fla.**
- **Allison Trophy, to a ground crew from the Flying Training Air Force, Webb AFB, Big Spring, Tex., headed by Staff Sgt. Richard D. Wright. They changed the Allison J33 jet engine in a Lockheed T-33 Shooting Star in 10 minutes, 32.2 seconds, defeated five other teams from their own command and the Crew Training Air Force, Laughlin AFB, Del Rio, Tex.**

Ryan Navigation Unit

Ryan Aeronautical Co. will produce a new automatic, self-contained airborne navigation system, the AN/APN-67, under a $5 million contract recently awarded by Navy BuAer.

Operating without ground-based facilities, such as are required for VOR or Tacan, the Ryan-developed APN-67 provides continuous information on position, ground speed, ground mileage, drift angle and ground track. By setting in data on the point of departure and the final destination, the device can provide the pilot with a single indication of his deviation from the prescribed course.

The APN-67 presumably could find use in civil aircraft and helicopters once security restrictions are removed. The device consists of a dead reckoning computer which employs a continuous-wave (doppler) radar to measure aircraft movement over the earth. (AW Dec. 27, 1954, p. 42). The auto-navigator has undergone three years of flight testing by Ryan and the Navy.

The Navy reportedly plans to use the new Ryan auto-navigators to explore Antarctic wastes (Expedition Deepfreeze) and to find magnetic compass variations over the ocean and polar regions (Project Magnet).

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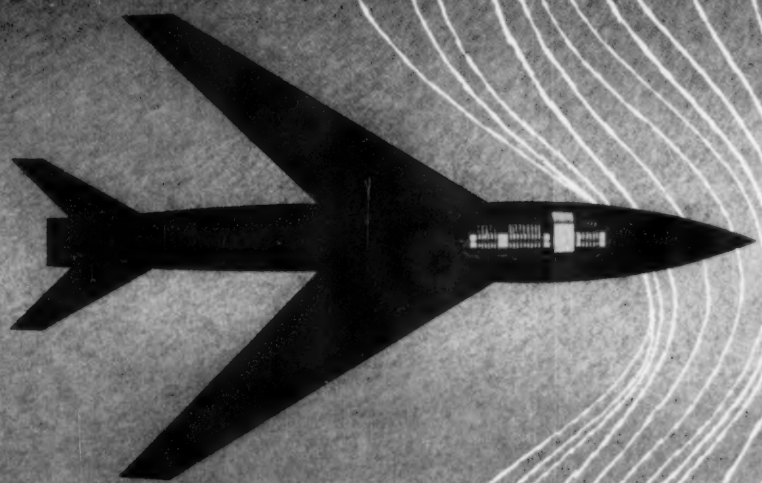

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How Russians 'Stormed Sonic Barrier'

To their long list of aeronautical accomplishments—both real and imagined—the Russians have added the practical application of sweepback as a means of reducing speed drag at high speeds.

The claim came to light through an article in the Red periodical Ogonyok.

The article presents the Soviets' modified history of the development of sweptback aircraft. It does mention the German Me-163, first operational sweptwing plane, but not its wing form. It says that similar Western planes all crashed, thereby proving the general lack of knowledge in the West.

It completely denies or overlooks the pioneering work done by the Germans, North American's sweptwing Sabre which flew in October 1947, and Boeing's B-47 which was being designed with sweptback wings at the end of World War II.

Even with these important omissions, the story makes interesting reading. It sets in place the relative state of the art in Russia and establishes Lavochkin as the pioneer of the development of sweepback in Russia.

Mikoyan and Yakovlev also are credited with designing aircraft which ". . . with sweptback wings . . . are now the pride of our aviation." Mikoyan's design is the MiG-15 and its later variants; Yakovlev's specific design is not known, but the story lends credibility to five-year-old German reports of a Yak-25 sweptwing fighter. A translation of the article's highlights follows:

The duel of creative thought and the battle of technical ideas goes on in the quiet of designers' workrooms for many years. In war and peace there is no letup even for a day in this silent struggle which has no temporary armistices, no final victories, no unconditional surrenders.

The designer's quest is an unending and troubled one. His mind is eternally obsessed with the solution of one tremendous problem—speed and altitude.

In the Beginning

Not long before the end of World War II, the attention of our designers was drawn to some interesting information which came from beyond our frontiers. In Germany tests were being carried on with a new jet fighter—the Messerschmitt 163, equipped with a Walter engine.

The mere appearance of a new plane wasn't surprising. But some of the things witnessed during the tests were astonishing. The powerful engine enabled the pilot to fly at very high speeds.

However, somewhere beyond the speed of 800 kilometers per hour the hitherto obedient and manageable plane refused to respond to the pilot's will. Classic methods of controlling the aircraft suddenly became worthless. The plane spun into an uncontrollable dive, and the tests ended in catastrophe. The Messerschmitt firm stubbornly continued its experiments. Planes crashed one after another, but no explanation was found for the mysterious phenomena.

At the very same time similar tests were under way in Great Britain and with exactly the same results. In testing Spitfire fighters the British tried to reach top speed in a power dive. But the plane went out of control. It was necessary to use superhuman effort to change the position of the ordinarily easy-to-move control stick. The plane acted with menacing strangeness. Dangerous phenomena such as vibration of wings, ailerons and the whole airplane structure were observed. And again catastrophe.

Catastrophe after catastrophe. The most experienced pilots perished over airdromes far behind the front lines. They had nothing to show for their deaths, not having moved aeronautical science even one step ahead.

After the end of World War II the United States also became intensively engaged in the solution of these problems.

The Americans evidently had made too much haste. Underestimating the nature of the phenomena which occurred at great speeds and not having studied the extremely complex processes that take place in the new field, they thought they would succeed in divining all the mysteries directly through test flights. They were wrong.

Plane after plane was built with kaleidoscope swiftness. The Americans changed profiles, engines and aerodynamic groupings of the components. But the pilots and the planes were lost.

Newspaper and magazine columns were filled with heartbreaking accounts of the tests. Sensation followed sensation.

At just that time there appeared in the American press for the first time two words which made hearts skip a beat even in pilots accustomed to danger. The two words were "sonic barrier."

Some people hastened to proclaim a crisis in aviation; other contended that aviation had run into a blind alley.

Soviet Deliberation

Soviet designers didn't rush to build experimental planes; they didn't hurry to get up into the skies until they had undertaken profound research into the laws of the new aerodynamics. The fight for higher speeds was brought into special scientific-research centers.

Taking the lead in this work was the largest institute—TSAGI (Central Aero-Hydrodynamic Institute) founded by the father of Russian aviation N. Ye. Zhukovsky. Even before the end of World War II broad research was carried out here into the phenomena associated with high speed and the search for solutions to the main problems was begun. . . .

(Here the author discusses the nature of the phenomena encountered at the "sonic barrier.")

The TSAGI laboratories, under the direction of the young physicist professor Vladimir Vasilevich Struminsky, carried on intensive research into the physical picture of air flow around bodies moving at high speeds. The scientists searched for essentially new methods of removing the difficulties which arise at sonic speed.

First Breakthrough

The investigations went in a single direction—toward the possibility of reducing drag at the wave crisis ("sonic barrier") so that safety of flight could be secured. At first there were few people who believed in the practical value of these investigations. But skepticism

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was easier to overcome than the wave crisis. The scientists stubbornly carried on.

If the old laws of aerodynamics turned out to be useless for solving new problems, then it was necessary, after first comprehending the nature of the phenomena, to evolve new laws and create an essentially new branch of science–aerodynamics of supersonic speeds. This was the job of a large group of scientists, engineers, and designers–a titanic task which marked the beginning of a new era, a new epoch in aviation. The theoretical basis of the amazing phenomena was found (in the TSAGI laboratories). Now all future research rested on a firm scientific foundation.

In 1946 the group headed by V. V. Struminsky hailed its first victory. It was a day of celebration, but for millions of people the victory of the scientists passed unnoticed. The newspapers carried nothing about it. Such is the fate of those who work in the advanced area of technology.

Lavochkin's Role

Scientist-designer and Hero of Socialist Labor Semyon Alekseyevich Lavochkin worked in this advanced area. In the struggle for higher speeds his design bureau also went in search of means of sharply reducing drag.

At first an attempt was made to find a solution by decreasing drag in small amounts: by improving the streamlining and airtightness of the fuselage and by working on the finish of the surfaces. Then they tackled the wings. They began to make them thinner and developed new, perfected profiles.

So much was hypothesis, so much was ideas and so much was disappointment!

Every new refinement was carefully studied. The planes were tested in wind tunnels and tested in the air. Success was modest, and they progressed slowly, literally fighting for each additional 10 kilometers of speed.

At one stage the designers thought they were close to their goal. Having tried dozens of different variations of fuselages, wings, tails and groupings of components and having gathered together all the accumulated experience, they decided to put together in one airplane all the best elements of previous models.

Outwardly the machine differed hardly at all from its brothers–the same straight wings, only thinner; the same fuselage, only more streamlined. In short it wasn't a basic solution to the problem, and the designers didn't form any illusions. They didn't even count on the new plane being able to fly at sonic speed, but it could get close to this speed. The entire factory "lived"

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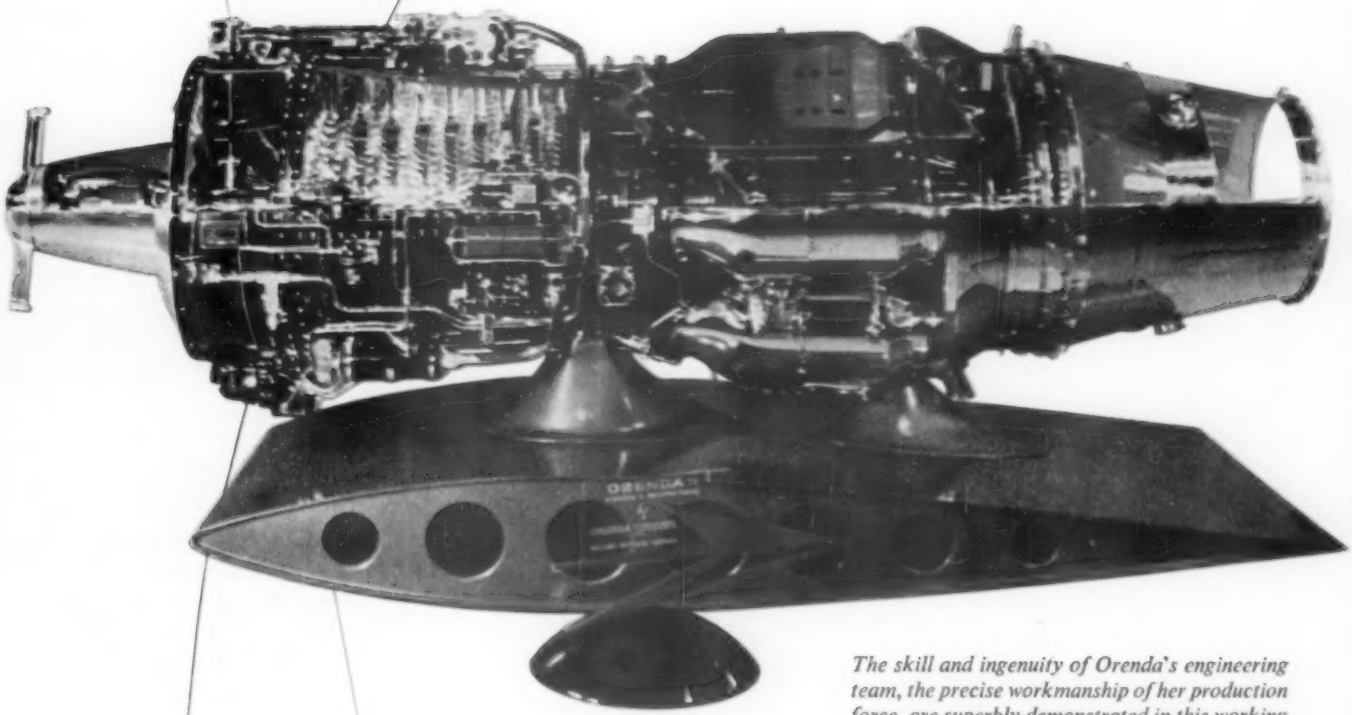
power going places



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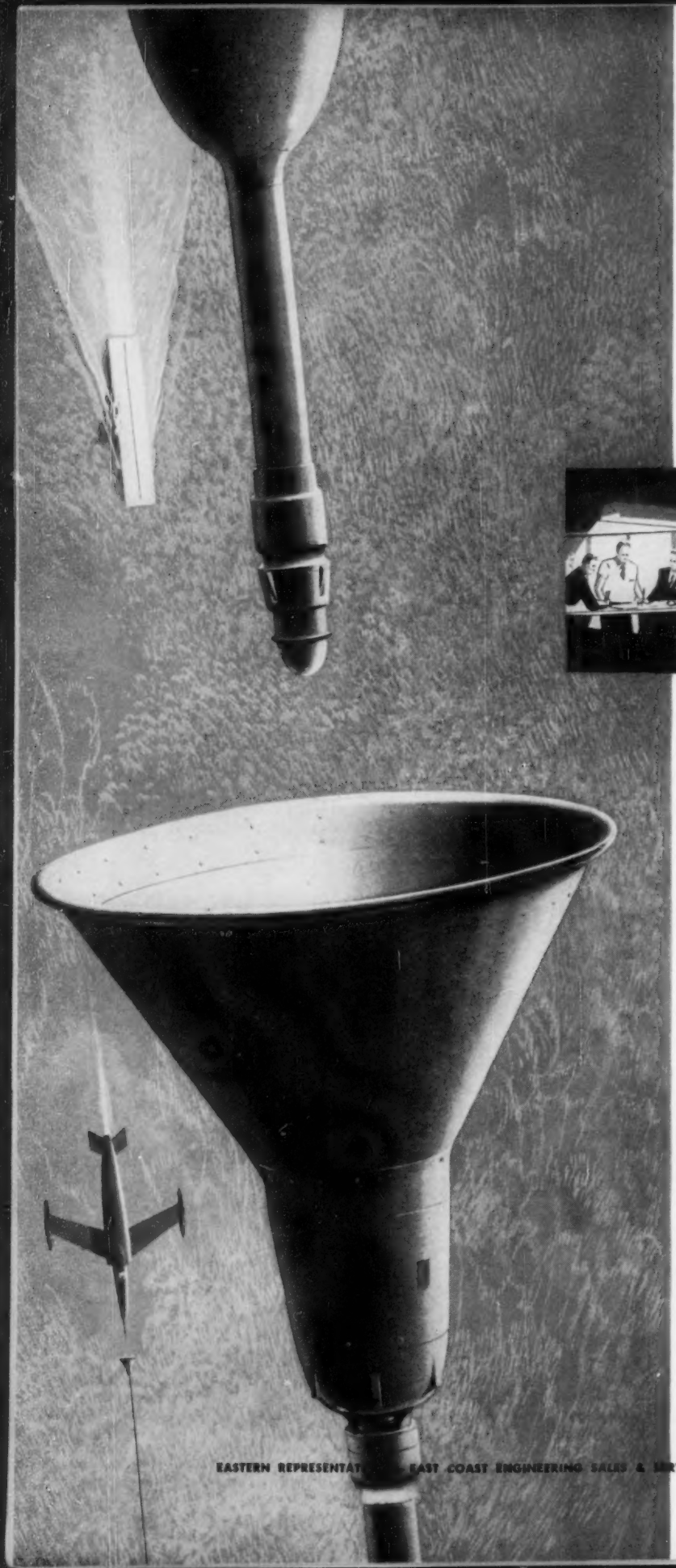

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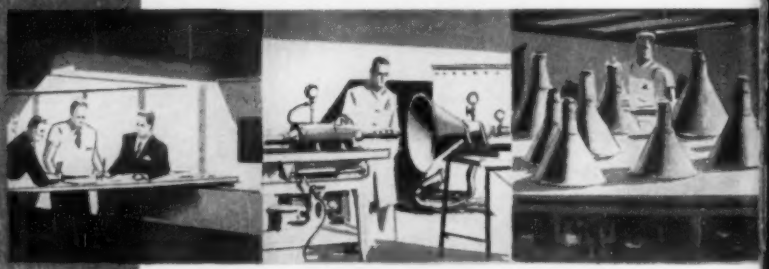

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this machine for several months. All the creative energy of the huge working force was put into this one machine.

Work went forward in the shops. But to the degree that the plane neared completion a feeling of dissatisfaction grew and strengthened inside Lavochkin. He realized that it was necessary to find some sort of essentially new approach which would result not in small decreases in drag at sonic speeds but in immediate sharp reductions.

This thought didn't leave him at his workroom, in his car on the way home, nor late at night.

Enter Sweepback

The TSAGI group headed by V. V. Struminsky was already busy at this time with research on the building of an essentially new type of wing—sagittal (swept back). According to the scientists' hypotheses, such wings should once and for all eliminate those difficulties of highspeed flying that up to this time seemed insurmountable. But here the scientists ran into serious trouble.

On the one hand, sweepback helped ease the wave crisis. On the other hand, where there was a large angle of incidence (attack), during takeoff and landing, and particularly while maneuvering, there were sharply-expressed phenomena associated with the sweepback. There was a breaking away of the stream of air particles which flow around the wings. The plane lost stability and controllability. It fell off on the wing and went into a spin. If this happened at low altitude the pilot couldn't even eject himself with a parachute.

TSAGI scientists found a means of ensuring against such difficulties.

Struminsky was theoretically sure that nothing unexpected would occur in the air. But how could he convince the designers of the correctness of his hypothesis and persuade them to build a plane with sweptback wings when literally every test of such craft in the West ended in catastrophe?

Lavochkin was the first to make a firm and unconditional decision to build the new plane design in his factory. Together with his assistants he used wind tunnels to study a multitude of models of his future aircraft, perfecting their form and finding the best aerodynamic groupings. And although construction of a new plane with straight wings was already nearing completion in the same shops, he had the guts to gather his aides together and tell them frankly:

"We won't continue in that direction. We must start all over again."

Much courage was necessary to wipe out at one stroke the results of previous work and begin from scratch.

Nobody in Russia had yet built airplanes with sweptback wings. Nobody except Struminsky could express confidence that such a machine would prove itself in the air. Then, too, sometimes even the most indisputable hypothesis had turned out to be worthless when put into practice. But boldness

Body Movement Guides KH-15

Test pilot Norman M. Loyd demonstrates stability of rocket-powered Kellett KH-15 by flying the craft with body movements only (kinesthetic control). The KH-15 was developed under Office of Naval Research sponsorship to study stability and handling characteristics of a small single-rotor helicopter in which significant rotor parameters could be modified. Indications are that the KH-15's gyro stabilizing system can be applied to any type of helicopter. Powerplants are two Reaction Motors hydrogen peroxide-rocket engines, one on each blade tip. Fuel is carried in the two spherical tanks alongside the pilot.

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and daring are always the marks of real creative genius, and Lavochkin without hesitation threw the entire efforts of his design bureau into construction of the new plane.

Before him lay a thick stack of drawings of completely original profiles for a plane. There was a narrow, cone-shaped body, a sharply-tapered nose and an original tail assembly slanted to the rear. But the main thing was the wings—short and angled backward like an arrow. The plane looked like an athlete ready to jump from a tower.

Thus came into being the first Soviet plane with arrow-like wings which marked the beginning of today's swept back aviation. It was a daring, revolutionary break with established canons. But the discovery didn't just fall from the ceiling. It can't be explained as a happy thought which suddenly and accidentally came to mind or as the result of the gifted perspicacity of its authors alone. It was prepared and predestined by all the previous progress of our advanced Soviet aeronautical sciences.

Yes, sweepback radically changed the amount of drag in flights at sonic speed. If formerly drag was designated by the figures 7, 10 and 14, now it rose only two or three times at the wave crisis. This was an entirely tolerable drag which could be overcome by engine power.

Only the Beginning

But solution of the main problem moved a series of new and associated ones in front of the designers. Some other way of mechanizing the wing, some other system of controls, different fuselages and different tail assemblies were required.

The plane had to fly not only at supersonic speeds but at the low speeds necessary for landing. However, the laws of airflow at subsonic and supersonic speeds were different. This meant that the aerodynamic composition of the plane had to be such that despite the different laws of airflow the craft would have the requisite stability and maneuverability under any flight conditions.

There had to be an air-tight cabin with steady pressure for the pilot's safety. . . . It was necessary to rebuild the entire system of controls, adding special apparatus to combat the strong opposing forces encountered at supersonic speeds and to keep intact the pilot's "feel" of the plane. . . .

At last, gleaming under the sun's rays, the first experimental plane with sweptback wings was smoothly rolled out onto the airport's concrete runway.

Struminsky stood alongside Lavochkin. The pilot fastened the canopy latch and took off. He confidently

INSIDE STORY

AUSTENAL SILENT TREATMENT

This is the inside of a creep rupture machine at Austenal Laboratories. A bar of ultra-strong alloy is subjected to high stress for many hours at jet engine temperatures until it finally ruptures.

The drawing symbolizes determination of rupture strength of an alloy to be used in Austenal's Microcast process for the investment casting of high temperature components for jet engines. This is one of many laboratory tests used to ensure the quality and dependability of the alloys used.

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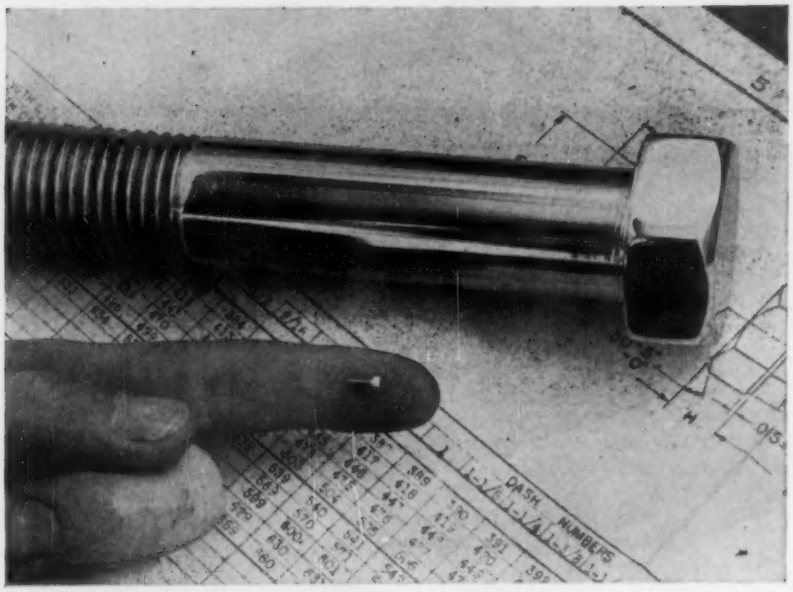

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gained altitude. No, the plane didn't break apart. It handled excellently and landed without incident.

Success of the experimental machine at once dispelled all doubts which still existed with regard to swept back wings. At the factories directed by designers A. I. Mikoyan and A. S. Yakovlev new military planes with sweptback wings were built which are now the pride of our aviation.

Lavochkin also built a new plane. And if the designers formerly were held back by fear of the unknown, now they moved boldly. To achieve greater speed the sweepback was increased another ten degrees.

But even such small changes in aircraft design required intense research, care and caution. And the first such flights didn't always end well for the pilots.

In Moscow cold weather arrived. It began to snow. Lavochkin shifted his next tests to the south—on the shore of the Black Sea. It was then decided to try to squeeze maximum speed out of the engine—to try, as they say in the West, to crash through the "sonic barrier." A new instrument—the Machmeter—was installed on the instrument panel. . . .

Supersonic Parade

Thus everything was ready for the decisive flight. Test pilot Col. I. Ye. Fedorov took the plane out on the runway without hesitation, took off, made a farewell circle of the airport and disappeared into the blue sky.

The turbine was working at full power. The instruments showed an altitude of 10,000 meters. The earth was a light-grey blotch beneath the shroud of cloud cover. Lavochkin's voice could be heard in the pilot's earphones.

Fedorov carefully banked the machine and then smoothly sent it into a dive. The plane shot downward. The Machmeter needle slowly crept upward, hesitated slightly at the mark and, having passed it, barely moved into the second circle. The job was done. Fedorov pulled back on the stick and brought the plane out of the dive without difficulty.

He was at 4,000 meters. Pulling off his oxygen mask he prepared to land. The historic event of conquering the "sonic barrier" came off with ridiculous ease. . . .

The glad tidings were flashed to Moscow. And from Moscow to the shore of the Black Sea came other news: A plane built by designer Mikoyan had overcome the "sonic barrier" almost simultaneously with Lavochkin's. Within a few more days friends congratulated designer A. S. Yakovlev (for the same achievement).

[*The dates of these flights are not*

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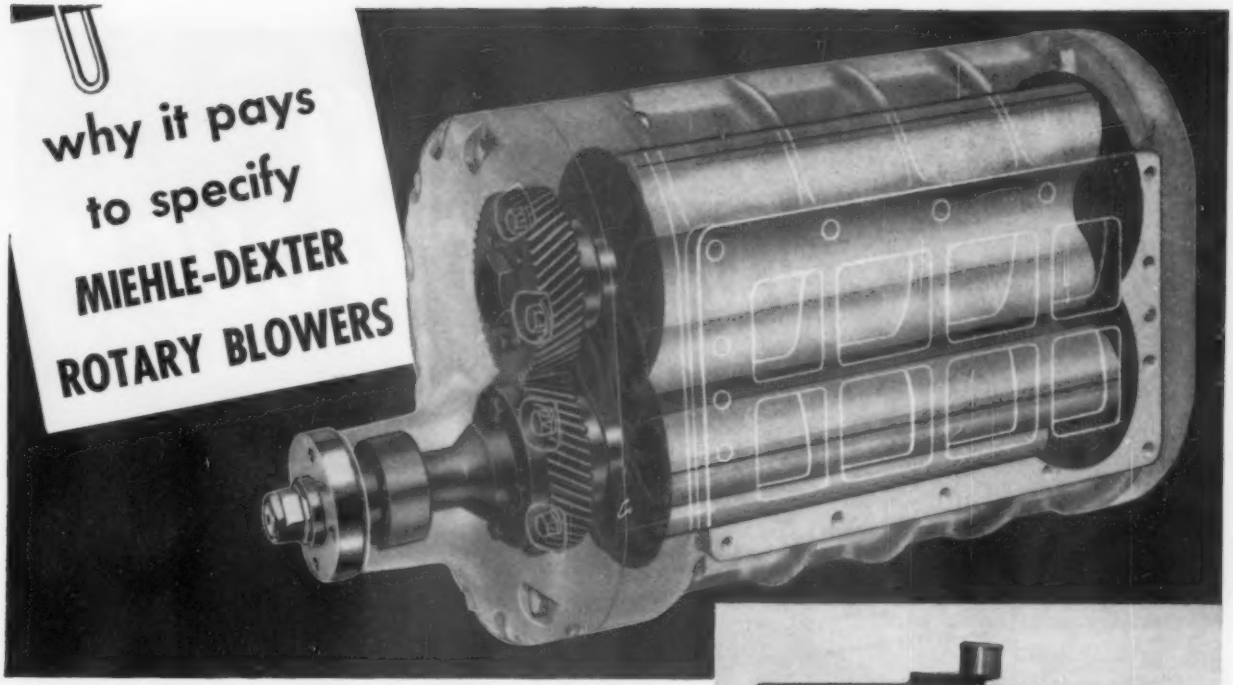

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given. *In the U.S., Maj. (then Capt.) Charles Yeager went through the "sonic barrier" in the Bell X-1 research lane, Oct. 14, 1947.—Ed.*]

With the "sonic barrier" done away with, we began to build newer and newer planes, each more advanced than the others. As we did, the top speed increased by jumps of 200 and 300 kilometers per hour.

Performance of the new machines was studied at the airport experimental factories, and the latest improvements were introduced. Suitable models were prepared for quantity production. Even here, however, with the basic problem already solved, everything didn't go smoothly. Difficulties still continued to confront the designers.

Mach Speeds

One of these involved Lavochkin. Under certain comparatively rare circumstances during tests the structure of his plane began to vibrate. Test pilot Fedorov easily stopped the vibration by changing the conditions of flight. He assured Lavochkin there was nothing to be concerned about. Lavochkin wasn't convinced but, try as he might, he couldn't find the cause even after 40 flights.

Finally he attached a device to the control stick which recorded the pilot's actions. . . . Fedorov took off and soon experienced vibration difficulties. . . . Then he heard a sharp crack, and the plane began to break up. . . . The pilot bailed out. . . . But the recording instrument and its record were found intact inside the crashed plane and indicated the cause of the vibration. Lavochkin eliminated the trouble by adding a kilogram of weight to the tips of the tail assembly. . . .

Now, with speeds measured in machs, Soviet designers have run up against "temperature troubles"—the heat barrier. . . .

At speeds above 2,500 kilometers per hour the fuselage and wings heat up to 250 degrees Centigrade. That's only one of many problems. . . .

The search continues.

Lockheed Gives Report On Half-Year Earnings

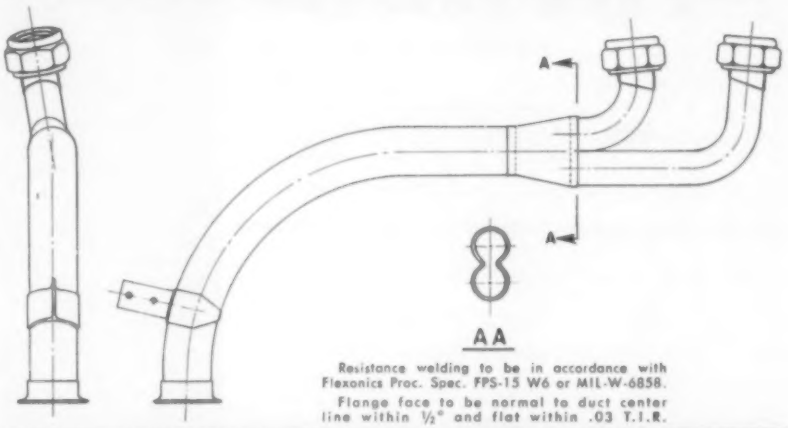
Burbank, Calif.—The half-year earning of Lockheed Aircraft Corp. were placed at more than $9 million, or $3.21 a share, President Robert E. Gross reported last week.

The figure represents a slight drop from the first six months of 1954 when earnings were placed at $10 million or $3.85 a share.

Higher returns from expanding commercial production were offset by a re-

FLEXON DUCTING *Design Briefs*

Complex Anti-Icing Duct Problem Solved with Unique Assembly Engineered by Flexonics



Resistance welding to be in accordance with Flexonics Proc. Spec. FPS-15 W6 or MIL-W-6858.
Flange face to be normal to duct center line within ½° and flat within .03 T.I.R.

Check **FLEXONICS** *for any of these components*

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FLEXON METAL HOSE, corrosion resistant steel, is manufactured in the broadest varieties of sizes and types for all aircraft applications.

FLEXON BELLOWS are made in an almost unlimited range of sizes and types to meet the most advanced requirements.

Intricate forming problems combined with the high dimensional accuracy requirements in production created a tough development problem in the anti-icing duct assembly sketched above. The transition-tube shown in cross-section A-A was inert arc butt formed from a single piece of welded SS 321 tubing (not two half shells welded together). The assembly is proof tested at 365 psig for five minutes. No evidence of leakage, cracking or deformation is permitted. Duct operates at 850° F.

Here's another example of the kind of weight-saving and sound engineering design resulting from years of practical experience and the most advanced manufacturing techniques. You can put this skill to work for you by sending an outline of your ducting requirements. Flexonics engineers welcome the opportunity to work with you towards the resolution of your ducting problems.

RFA-27

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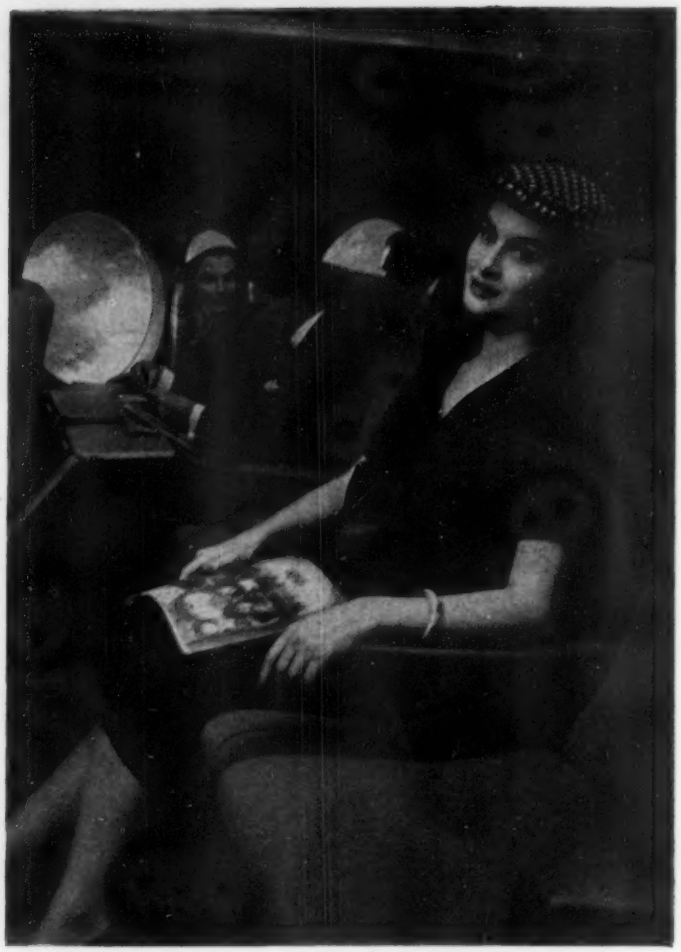
IN *comfort*



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*The seat with the fold-away utility table

. . . the *Zephyr* line by AEROTHERM

Cruising at 25,000 feet, you sit back and enjoy the luxury of a wide, contoured seat that's as comfortable as your old favorite chair. And as the miles fly by, at over 300 an hour, you touch a lever and lean back for a quick nap. There's plenty of leg room to stretch out. You close your eyes and have that lazy sensation of floating on air.

In fact, that's just what you're doing when you ride in the new foam rubber cushioned Zephyr Line seats manufactured by Aerotherm, for Capital's new Viscounts.

There are many other unique features. Exclusive with these seats is the personal table that drops into position for mealtime . . . or for catching up on those letters you should have written. Your ride on the Viscount is practically vibrationless . . . and before you know it, your trip is over and you arrive relaxed and rested in a Zephyr seat.

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duced volume of military sales, Gross said. Sales in the first half of 1955 were 13% higher than the previous six months, although slightly lower than those for the same 1954 period. The total sales for the six-months were $372,751,000.

Lockheed's present backlog stands at $1,061,077,000, Gross said.

This does not include orders for 24 Super Constellations received in August which totaled approximately $50-million.

Sales to commercial airlines will continue strong through the year, the company president predicted, with dollar value expected to double over any pre-1954 year.

Super Constellation sales for the first six months were within a fraction of equaling the 12-month total of more than $90 million last year.

Substantial military orders for the F-104A day superiority fighter also are anticipated.

Employment is expected to hold steady or increase slightly later in the year, Gross said. Mid-year employment totaled 52,000, the highest in ten years with the exception of the Korean war peak of 54,000 in 1953.

Gross said working capital at mid-year totaled $85,751,000, as compared with $49,166,000 a year ago. Most of the increase was due to proceeds from $30-million worth of debentures. At the same time, Lockheed has cancelled a credit agreement for $50 million with a group of banks because of its present "strong cash position."

Gross listed this backlog by divisions: California, $691,108,000; Georgia, $307,484,000, and Missile Systems, $28,931,000.

The rapidly-growing Missile Systems Division showed six-month sales of more than $9 million, as compared with a 12-month total of $7 million last year.

The Lockheed president listed this production picture for his company:

• **Two commercial** transport models in quantity production and two new models ordered for 1957-58, including the turboprop Electra.

• **Four U. S. Air Force** models in quantity production, with two more just getting started.

• **Three U. S. Navy** models in quantity production and a fourth near the production stage.

• **Rapidly-expanding** missile program still in the research and development phase but expected to lead to production orders.

• **Design contracts** for a jet tanker and long range interceptor which may result in future contracts.

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Aviation Week Buyers' Guide, Nov. 28

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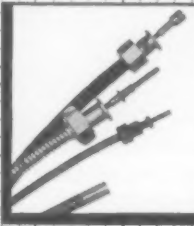

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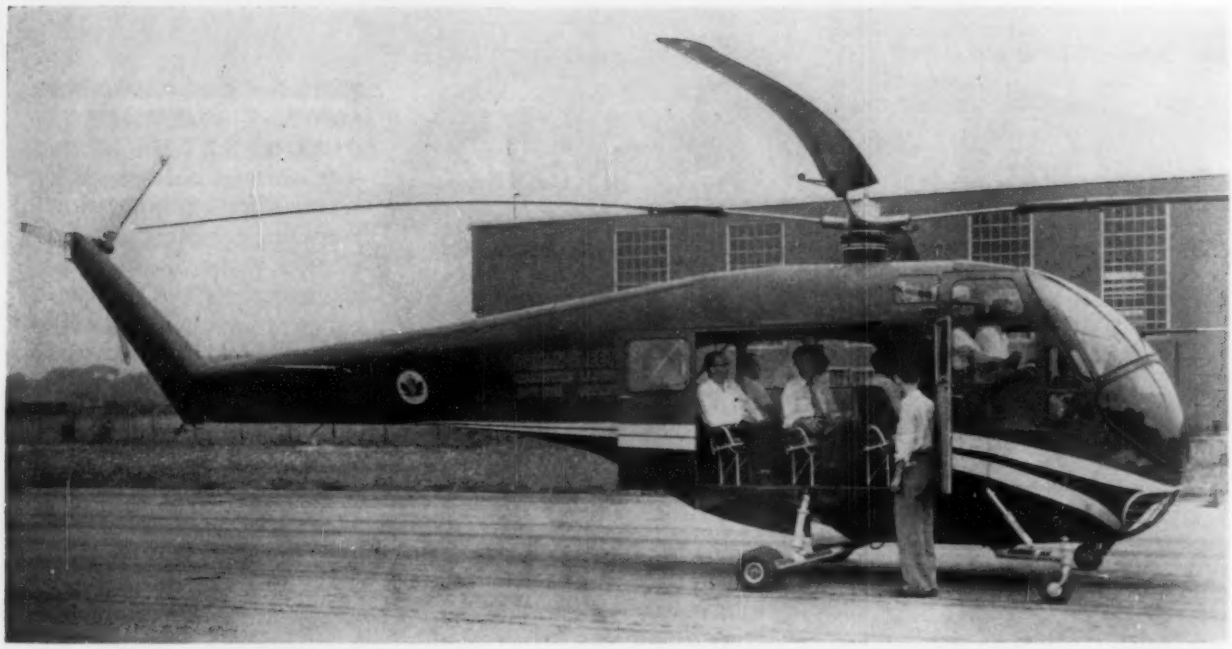


EIGHT-PLACE LZ-5 HELICOPTER is playing a leading role in Doman's plans for expanded production and sales of commercial craft.

Doman to Expand Civil, Military Projects

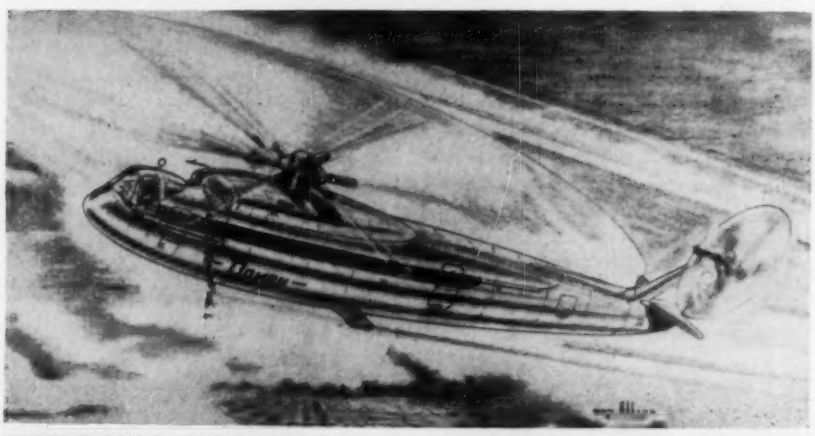
By Erwin J. Bulban

Danbury, Conn.—Doman Helicopters, Inc., is preparing a major expansion to meet its planned military and civil rotary-wing aircraft program.

Final decisions on the requirements, including the additional financing needed, will be made within a month, Doman company President Donald S. B. Waters informed AVIATION WEEK.

The company's new activities embrace:

- **Work on Phase 1 of a fuel tanker helicopter (FTH) concept for USAF.**
- **Design of a large tri-engine craft,** which has been submitted in Royal Canadian Navy's new anti-submarine copter competition by the company's licensee, Doman-Fleet Helicopters, Ltd., Fort Erie, Ont., which has the primary responsibility for the project. Fleet is supplying manufacturing facilities, Doman-Danbury the engineering backup. Doman-Fleet feels that its production capability gives it a decided advantage over other entries, who do not possess Canadian manufacturing plants.
- **Study of helicopter all-weather instrumentation.**
- **Preparation for production** of its $120,000 LZ-5 eight-place commercial helicopter. The LZ-5 is expected to receive its Type Certificate from Civil Aeronautics Administration within the next two months, according to Doman officials.



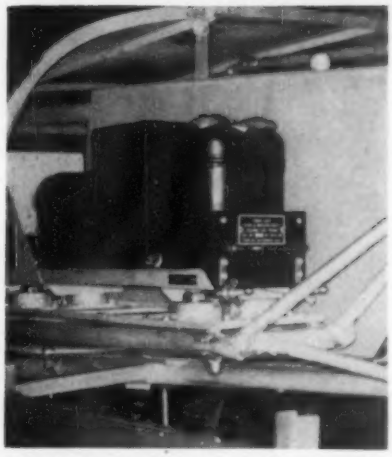
THREE-TURBINE ASW COPTER is shown in this artist's drawing of the design study.

CAA pilots are now flying one of the two YH-31 military counterparts of the LZ-5 under a Type Inspection Authorization to verify design and performance data for final approval.

An expected initial purchaser of the LZ-5 is Heli-Mex, a Mexican firm that plans a network of helicopter services throughout that country. The new Domans would be used for trunk routes and light Bells for feeder operations. Heli-Mex currently is negotiating for seven LZ-5s with spares, costing approximately $1 million. Waters said initial deliveries can be made six months after a contract is signed. Doman expects to train Heli-Mex crews here in Danbury and will assist the company in setting up service facilities.

Waters said that during a trip to Mexico with Giles Montgomery, his sales manager, he noted "terrific" enthusiasm for the helicopter. The governor of Vera Cruz pointed out 130 towns on a map of his state where he said he would provide heliport facilities. The governor, Waters said, also promised tax concessions and other benefits for the Heli-Mex operations.

LZ-5 output at Danbury literally awaits the word "go." Production drawings are completed, tooling requirements have been decided upon and some 150 vendors have been lined up already. "All we have to do is write the work orders," a Doman official said. An early indication of LZ-5 production plans is given in the report that the firm's engine supplier, Lycoming, has



ALL-WEATHER instruments being studied by Doman for helicopters include Lear Nafli (1) and Specialties climb indicator (2). Nafli remote installation is shown in lower photo.

cooperated in extending tooling costs for the SO-580 over a spread of 150 powerplants.

Additional design growth is foreseen in the LZ-5's future. For example, by using a monocoque fuselage, assembly would be eased and the added streamlining would increase the copter's speed by about 15 mph. Rotor blade developments may include use of fibrous glass reinforced plastics and anti-icing is expected to be included to enhance all-weather utility. Plans also include use of skids or floats on the present four-point landing gear.

Military Work

As part of Water's policy to participate strongly in defense work, Doman has put increased emphasis on new military projects. The company submitted a proposal to the Air Force on the use of helicopters as fuel tankers and then won a Phase I contract over 13 competitors to work on the study. The initial phase, slated for completion in December, involves adaptation of three current aircraft—the Piasecki H-21, and

WHEN IS A THERMOCOUPLE EVEN BETTER?

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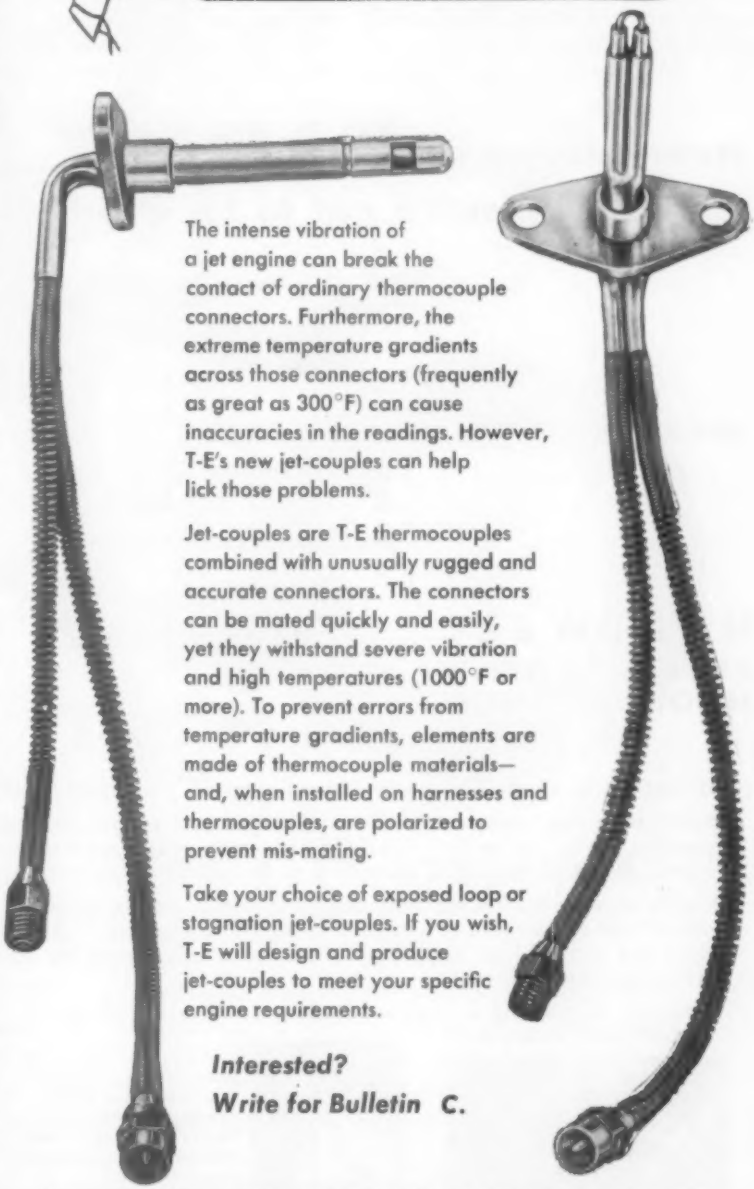

The intense vibration of a jet engine can break the contact of ordinary thermocouple connectors. Furthermore, the extreme temperature gradients across those connectors (frequently as great as 300°F) can cause inaccuracies in the readings. However, T-E's new jet-couples can help lick those problems.

Jet-couples are T-E thermocouples combined with unusually rugged and accurate connectors. The connectors can be mated quickly and easily, yet they withstand severe vibration and high temperatures (1000°F or more). To prevent errors from temperature gradients, elements are made of thermocouple materials—and, when installed on harnesses and thermocouples, are polarized to prevent mis-mating.

Take your choice of exposed loop or stagnation jet-couples. If you wish, T-E will design and produce jet-couples to meet your specific engine requirements.

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Sikorsky's H-34 and H-37—to fuel tanker helicopters.

The FTH concept is planned to provide greater in-the-field mobility to Army ground forces by refueling their vehicles from the air by copters, freeing the forces from dependence upon slow and vulnerable tank trucks which are committed to using roads. The tanker copters could also refuel other copters and Army aircraft in mid-air.

In its bid to enter the Canadian market, Doman-Fleet has proposed an anti-submarine helicopter which would gross approximately 17,000 lb. and is planned around three General Electric T58 turbines. The powerplants are nested in the upper section of the fuselage just behind the cockpit. Weapons are carried in retractable launchers in the large cabin. The ASW copter's tail is hinged so that it folds upward over the fuselage. The four main rotor blades also fold to facilitate stowage of the copters aboard carriers.

The new ASW project is a joint effort between the Danbury firm and Doman-Fleet Helicopters, Ltd., Ont. D-F is at present primarily a manufacturing facility but eventually plans to become a completely-integrated design, development and production organization. The Canadian firm will be responsible for design, development and production of the ASW copter if a government contract is received.

Projections of this design for civil use have also been laid out. The commercial version, powered by three T58s, would seat 20 passengers and have multiple loading, including a ramp under the tail. Another similar configuration is planned for tandem rotors.

John Mazur, director of military contracts, said the company is not committed to any particular rotor layout philosophy. Single or tandem rotors are both under consideration.

Copter Instruments

To increase copter utility and develop an all-weather capability, Doman is also doing considerable study of instrument requirements for rotary-wing operation (AW Sept. 5, p. 65).

Ward Davis, formerly of Lear, who works in customer relations, is evaluating current equipment in an effort to develop a standard blind-flight panel of the best available instruments. His requirement: It must be an off-the-shelf item, in production or going into production soon. Among the instruments Doman currently is studying is the new Lear three-in-one Nafli pictorial presentation, which shows dive, climb and their angle and direction, and angle of bank and heading on an azimuth scale (AW June 13, p. 45). Another is an instantaneous vertical speed indicator, which is said to sense immediately changes in rate of change of altitude of as little as 100 fpm. This instrument is manufactured by Specialties, Inc., Syosett, N. Y.

The instruments Davis will study in developing of a standard panel include attitude and azimuth indication, airspeed, instantaneous vertical speed, yawmeter, magnetic compass, sensitive altimeter and engine instruments. A turn-and-bank indicator will be used as a standby in event of failure of the attitude indicator.

Davis would like to see an airspeed indicator with an expanded scale in the 20-30 mph. range with relatively slow needle motion during helicopter cruising speeds. Many current instruments, which were developed for fixed-wing aircraft, have too much needle "bounce" in these low speeds to provide the necessary accuracy for copter work, Davis said.

New Aerodex Contract

Aerodex, Inc., has received two USAF contracts totaling approximately $4 million for aircraft engine overhauls at its Miami plant. One is a follow-on award for Wright R2600 overhauls through July 1956. The other, for Pratt & Whitney R2800s, will run during the same period.

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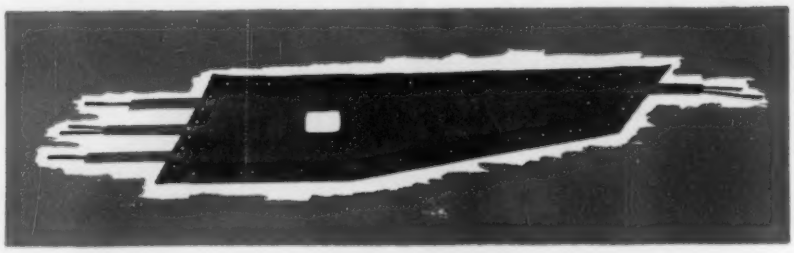

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THRUST & DRAG

Today's lesson in Technical English comes from a recent report issued by a large Government aeronautical research establishment. The report is aimed at the "flying farmer" or the spray-dust operators.

The major problem was to find ways to improve the swath coverage and, particularly, to make it wider and more uniform. Following are the conclusions of the report with translations into Ordinary Speech:

1. *Greater lateral dispersion of aerial sprays will result when the position at which droplets are ejected is moved toward the wing tip, when the mean diameter of the droplet spectrum is reduced, or when either the airplane lift coefficient or the altitude is increased.* **Translation: Move the nozzles outboard, make them smaller, fly higher and a little slower.**

2. *The uniformity and effective width of the swath is improved by increasing the mass efflux rate with distance from the plane of symmetry.* **Translation: Put more nozzles near the wingtip than you do near the fuselage.**

3. *As compared with a spray spectrum of 300-micron mean diameter, the spray spectrum with a mean diameter of 200 microns allows greater flight-path spacing and produces a more uniform deposit. Moreover, the degree of uniformity is less sensitive to changes in the spacing of adjacent passes of the airplane.* **Translation: The smaller the drops, the better.**

* * *

American Airlines' new luggage tester (AW July 25, 1955, p. 104) is a grand idea. But it is incomplete, and needs a little more work to make it completely practical. So I've prepared a modification, which is offered to the airlines, gratis.

It consists of a simple plywood mockup of the space beneath a DC-6 or DC-7 seat. Alongside it is a mockup of the largest piece of "carry-on" luggage the passenger can take aboard.

To use it, a passenger places the mockup of the luggage in the mockup of the space, and then tries to fit his feet in also. If this works, the passenger ahead of him is allowed to place his bag under the seat. Otherwise, the passenger ahead will have to hold his bag in his own lap.

This is much more equitable, and I predict the idea will gain great favor among the longer-legged air travelers.

* * *

The following came from two anonymous—by request—engineers. It's new to me, and so we're not going to pass it

All business is specialized

. . . and nothing specializes on <u>your</u> business like your business paper

Here's a smart business man. He spends his time where every sitzmark parks a prospect at his feet. It's simple sense: He *specializes* . . . and it *pays*!

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A copy of this quick-reading, 8-page booklet is yours for the asking. It contains many facts on the benefits derived from your business paper and tips on how to read more profitably. Write for the "WHY and HOW booklet." Room 2710.

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One of a series of advertisements prepared by THE ASSOCIATED BUSINESS PUBLICATIONS

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. . . call BRIDGEPORT for service!

Need fast delivery of aluminum extrusions to complete that job on schedule?

Bridgeport is set up to meet your demands! A phone call will put all our resources behind that special job—or any number of them—to deliver the shapes you want . . . when you want them.

No limits or short-cuts on quality, either! With over 800,000 sq. ft. of modern production facilities, Bridgeport can extrude a wide variety of standard or specially designed shapes in any extrudable alloy . . . to close tolerances . . . and to meet your exact requirements.

Bridgeport flexibility is the answer! We have the capacity of the large producer . . . the flexibility of the small one. Our customers enjoy the benefits of both.

Take advantage of this important service benefit and Bridgeport's 90-year reputation for quality in metals. Join the growing number of aluminum fabricators who use Bridgeport as a steady, dependable source of supply for extrusions.

Keep Bridgeport in mind, too, for die, contour and hand forgings. There's a Bridgeport Sales Office near you with information on our personalized service and fast delivery. Call us today.

Take advantage of Bridgeport's fast delivery of extrusions within these general limits:

Length—
Max.—Heat Treatable Alloys 43 ft.
Max.—Aged 63S-T6 45 ft.

Weight per ft.—
Max.—50 lbs.
Min.—.250 lb.

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- Bridgeport has two large tool and die shops fully equipped for making all extrusion and forging dies.
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EXTRUSIONS, DIE AND HAND FORGINGS

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on. Here's their opus.

Dissertation on the Theory of Mutilation

From the beginning of time, man in his unquenchable thirst for knowledge has developed tools for his trade to help raise him from the depths of total ignorance. Out of the dark ages, the first flickers of light were seen as genius bloomed in the great minds of Leonardo da Vinci, Newton, and more recently Einstein. Today, due to the complexity of modern problems, the calculus and other classical branches of so-called higher mathematics need supplementation to bring them up to date. This is especially true in aeronautics where each day the engineer strains to reach new goals set up by the fertile imagination of the Sales Department.

After years of research study and unbiased thinking, a new form of analysis has been developed. Problems which are not amenable to differentiation and integration are now completely subdued by mutilation. This is not to be confused with interpolation and extrapolation but is closely related to extravasative substitution which consists of letting all variables be equal except troublesome ones which are entirely omitted since they are not worth even writing down.

Any engineer who has accumulated much mileage is familiar with the mutilation of data (and some hibited characters never use anything else) but a need exists for a concise explanation suitable for on-the-job training of recent college graduates. This dissertation is a first attempt at filling this need.

The essential steps in this process are to pre-select a ball-park number for the result which is to be obtained from a given analysis and then to search frantically for some theory which will zero in on the desired trend and fit standard drafting templates.

In this short-hair branch of mathematics

Electric Haberdashery

The Martian device above was designed by ARDC for the Ground Observer Corps. Receiver picks up frequency impulses from radar of low-flying bomber.

(Advertisement)

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.

You read a lot about the heat barrier these days and its menace to structures, performance and pilots. This last I can attest first hand. Meet a "hot box" guinea pig!

The oven in which I was roasted was a five-foot metal-sheathed chamber at UCLA, built for Air Force contract experiments to determine human reaction to extreme heat.

I was "done" in 20 minutes with a high of 247 degrees — 35 points above boiling.

There was no glamour in being a subject. They fitted me in full-length woolen "long johns" and a maze of wires with various thermo-couples and electrodes to measure body temperatures and show heart reaction. A cotton sweat band circled my forehead. Shields protected my ears. My feet were encased in heavy mukluks and my hands in long gauntlet gloves.

Perspiration, they explained, would enable me to survive the chamber rather than cook like a side of beef.

In an actual emergency the more clothes a pilot is wearing, the better his heat tolerance, but this test was designed to show reaction under the most critical conditions, including the injection of steam into the chamber for high humidity.

To gauge the effects on my mind, they introduced me to a modified Link trainer I would attempt to "fly" in the hot box (constant airspeed, course and altitude at level attitude), then they had me fly the rig outside the chamber for 10 minutes to give them a base line of performance for comparison.

Not until just before I was to ride into the chamber on the Link did I realize there would be no gradual build-up of heat. The box was at 247 degrees, but would "cool" to 225 degrees when the door was open for five seconds to permit my entrance.

Even before the door locked shut, the heat hit me like a vast physical blow, and a sharp sense of suffocation panicked me for a moment as invisible flame clutched with inexorable, tightening pressure over my entire body. Involuntarily, I hunched into a ball in an effort to shield myself from the coiling scorch.

Then the sweat started pouring over my face, soaking my woolens from chin to feet, an ally fighting back for me, forcing the heat to dissipate part of its wrath by turning liquid into vapor . . . evaporation.

Once over the initial blow of the heat, I straightened up and started working the Link's controls, meanwhile peering now and then through the heavy glass port for reassurance from the observers outside. By intercom they told me the heat was 230 degrees and my pulse (a normal 84) up to 120 – partly from fright, no doubt.

As I got the rig "on course and level," I noticed the oppressive smell of heat. Or was it just the singed wool and the stifling, sweating walls of the chamber?

Breathing through my mouth wasn't bad, for the hot air was cooled some 100 degrees in the brief throat passage. But inhaling through my nose was like holding a lighted match to my nostrils. I touched my glove to my cheek and promptly got burned by the searing leather.

"When you've had enough, say so," I was advised from outside the chamber. "If you get faint or sick or nauseated, tell us at once."

Minute by minute the heat squeeze increased, and I could feel tension mounting within me as my heart beat accelerated under the strain. In 10 minutes the temperature was up to 238 degrees, my pulse was up to 150.

Until that point, I was doing fairly well with the controls, but then the needles started slipping off, and I found it harder and harder to correct.

I was overwhelmed by the heat, my mind numb, my coordination completely shot. They were watching me very closely now, and I realized dimly that I was gritting my teeth to keep the tightening tension from bursting me.

Heat: 247 degrees – Pulse, 171.

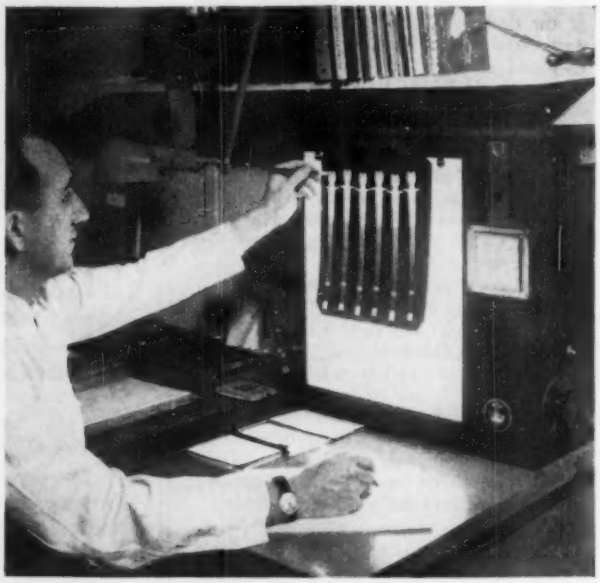
I knew I was all but cooked in 19 minutes and asked for one minute more. They would have pulled me out in 60 seconds anyway, for my pulse jumped to 176, just below the maximum 180 they would permit.

Once again in the blessed cool air outside, my head ached, my eyes burned and I talked irrationally. I'd lost a little better than two pounds.

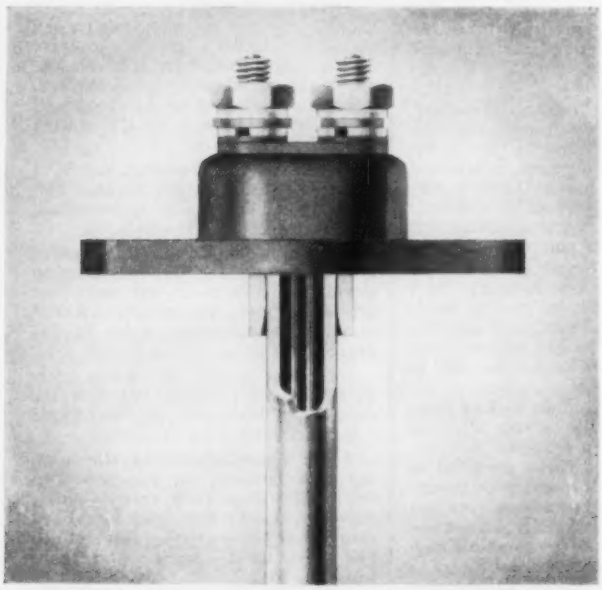
But someday I can truthfully tell my grandchildren that at one time I was the hottest reporter in the world!

How Fenwal Thermocouples add certainty to modern flight

1. FOR PROTECTION IN FLIGHT Fenwal Thermocouples keep jet pilots *accurately* informed on heat conditions inside gas turbine aircraft engines. They are ever alert to indicate and/or control critical high temperatures — to protect both pilot and plane in flight. Fenwal *custom-designs* a full line of Aircraft Gas Turbine Thermocouples for all jet engine needs.



2. X-RAYED FOR QUALITY at crucial stages of production, every Fenwal Thermocouple also undergoes further exacting tests for dependability. These include calibration inspection against Government Standards, double-checks for insulation resistance throughout operating temperature range, flame tests to assure fast, accurate response for extra safety in flight.



3. EXCLUSIVE "BELL MOUTH"* within the collar of Fenwal Thermocouples cushions and spreads vibration strain and eliminates high point-of-stress concentration. This means longer Thermocouple life. It is but one of many *Fenwal firsts* evolved during Fenwal's custom-engineering of *over 40 special types* of thermocouples . . . each *precision-engineered* to engine manufacturers' specifications for peak performance.

4. FOR MORE FACTS about Fenwal Aircraft Gas Turbine Thermocouples see Fenwal's new illustrated brochure. Fenwal — already a leader in the Aircraft Over-Heat and Fire Detection field — is fast becoming a leading supplier of custom-designed thermocouples for temperature indication and/or control in jet aircraft. Write for *your* copy of this brochure now to **Fenwal Inc., Aviation Products Division, 129 Pleasant Street, Ashland, Mass.**

Fenwal **AIRCRAFT GAS TURBINE THERMOCOUPLES**

Sense temperatures precisely . . . to fit your needs

*Pat. pending

the rules are quite simple and only the following formalities exist:

1. Use Egduf Factors liberally. However only unscrupulous knaves resort to Backwards Egduf Factors (any number greater or less than one which gives the right answer). The distinction here is that B. E. Factors give perfect answers according to standard theories by judicious manipulation of the raw data, while mutilation is an intermediate operation performed between the initial and final steps and the object is merely to prejudice the results. (The extension of this process to the treatment of travel expense accounts is obvious, and the details are left to the reader.)

2. If any variables in the problem become troublesome, divide them by themselves. The shrewd analyst can then elect to cancel the resulting constants against each other, two at a time, according to "The Law of Perfect Compensation" provided that he is in a fire drill—and not more than once in any analysis.

3. The practice of setting things equal to zero (as in differentiation) should be avoided since it can only yield nothing—and nobody wants nothing. Anyhow, you never want a maximum or minimum—only optimums.

The use of automatic computing equipment does not make the process any easier but it tends to snooker the customer so try it by all means. A new International Business Mutilator is being developed which will eliminate all but the most trivial solutions.

5. Above all, don't goof. Real gone mutilation may never win you a marble ash tray but failure means professional Hari-Kari.

6. If at first you don't succeed—iterate.

It has been suggested that the operator in this field be called a mutual (hence the partial operator would be a pari mutuel) in keeping with the nomenclature of a differential and an integral. But such discussion is from nowhere because the symbols are not readily available. The only notation consists of undecipherable markings inserted between other calculations by means of a soft pencil, smudged with the palm of the hand and typed over each other in final reports.

Finally, remember the key phrase: "If in doubt, don't differentiate—mutilate!!"

—DAA

RTCA to Take up Aviation's Challenge

The Electronic Challenge in Aviation's Advance is the theme of the Radio Technical Commission for Aeronautics' Washington meeting Sept. 29-30.

A status report on Tacan will be presented by Col. J. Francis Taylor, Jr., director of the Air Navigation Development Board. The technical program will be based on the work of RTCA's special committees on automatic flight control; course line computers; VHF utilization plans; helicopter air navigation, communication, and traffic control.

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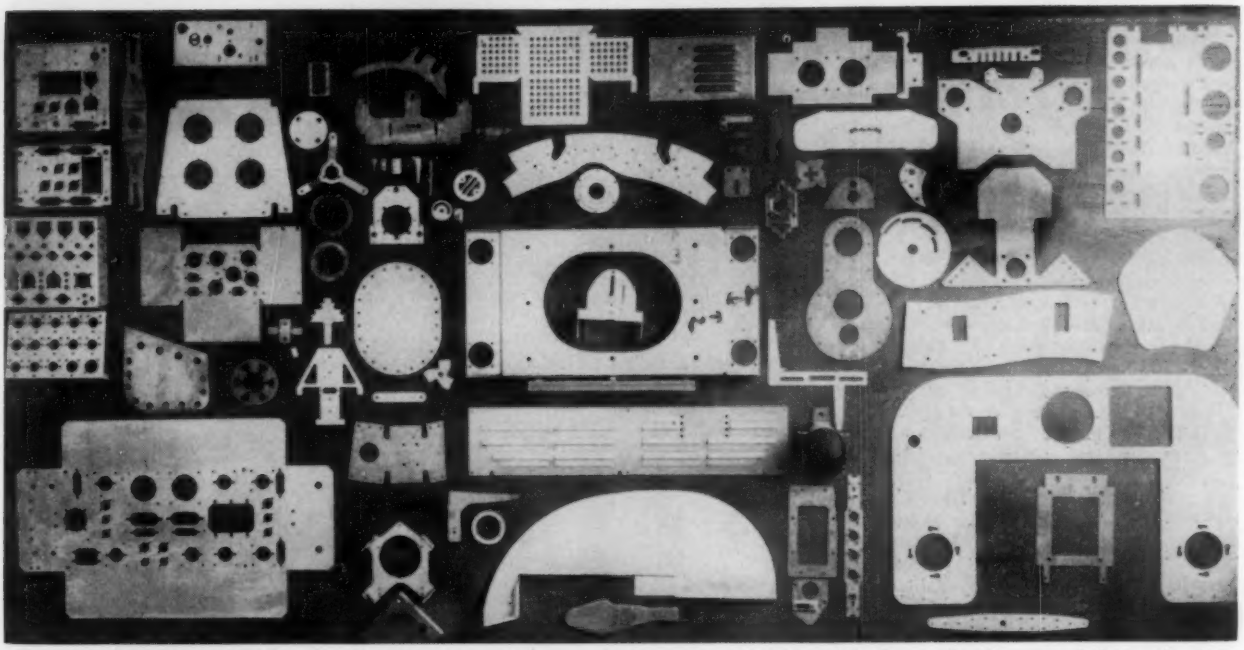


WIDE VARIETY OF STAMPINGS produced by Templet process is shown in this display. Metals are aluminum, steel, brass, titanium.

Steel Rule Technique Cuts Costs of Metal-Blanking Dies

By Henry Lefer

A cost-cutting, time-saving technique for making sheet metal stamping dies and producing stampings is now available for license to the aviation industry.

The patented technique basically uses plywood-supported high-carbon steel rules in conjunction with a steel male die in place of conventional steel plate dies.

It was developed by Templet Manufacturing Corp., and is being marketed by an offshoot, Templet Industries, Inc. It has been used to cut aluminum up to ¼ in. thick, various grades of steel, including stainless, and brass, to tolerances as close as .001 in.

Recently Templet has extended the process to the cutting of titanium sheet, producing clean pieces free of burrs.

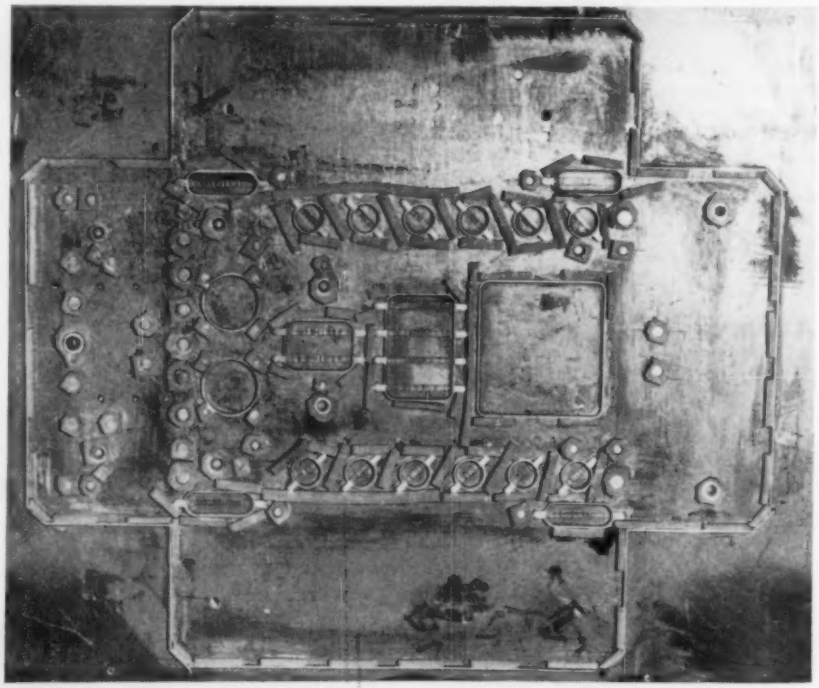
Republic Aviation has been experimenting with the use of steel rule dies for blanking titanium (AW June 27 p. 9), and is reported satisfied with the results.

The Templet process produces results usually obtainable only with expensive dies, the company claims. Shearing, notching, piercing, punching, extruding and stamping can be done in a compound operation with one die. It is possible to cut louvers with the Templet dies.

The die structure is flexible enough to permit working to close tolerances, even where the level of technique and skill is low. The dies are light and easy to handle, are quickly installed or removed from the press. Size of stampings is limited only by the size of the press bed.

Templet Industrial Process dies made for blanking aluminum have been used over and over, set up many times, remained in good running condition after stamping thousands of blanks.

The company claims dies for aluminum should last indefinitely. Exceptionally long life is also claimed for



TYPICAL TEMPLET DIE for .064 aluminum produces various punchouts as it blanks.

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ACCURATE! INSTANTANEOUS!

Developed Specifically for LIGHT AIRCRAFT and HELICOPTERS.

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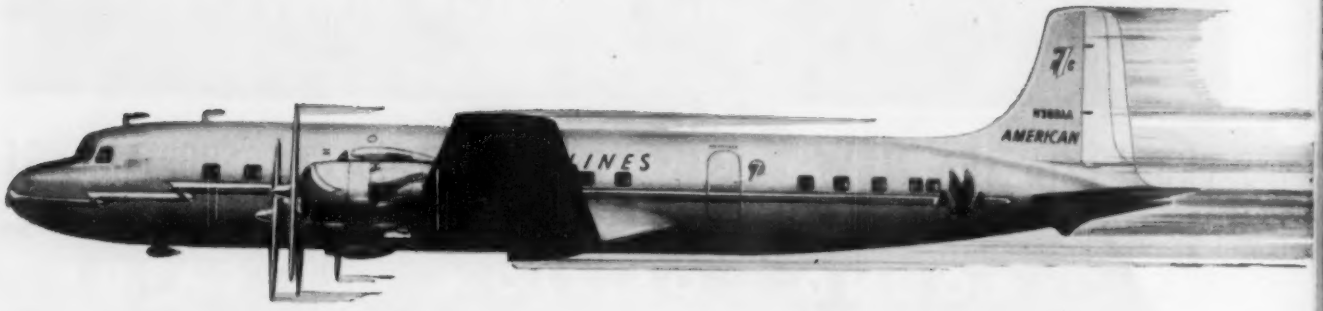

Cruising at 365 miles an hour on powerful turbo-compound engines, American Airlines DC-7's span the continent in such short time that if you wish, you can have lunch in New York and late dinner in Los Angeles.* The demand for passenger-space has necessitated additional non-stop flights between New York and Los Angeles, and between Washington and the coast.

Sinclair Aircraft Oil keeps those mighty engines purring all the way, for American has depended on Sinclair for reliable engine lubrication for 20 years. *Today, 45% of the oil used by major scheduled airlines in the U. S. is supplied by Sinclair.*

And the millions of miles logged, and the economies totaled up, are proof positive that you, too, can depend on Sinclair.

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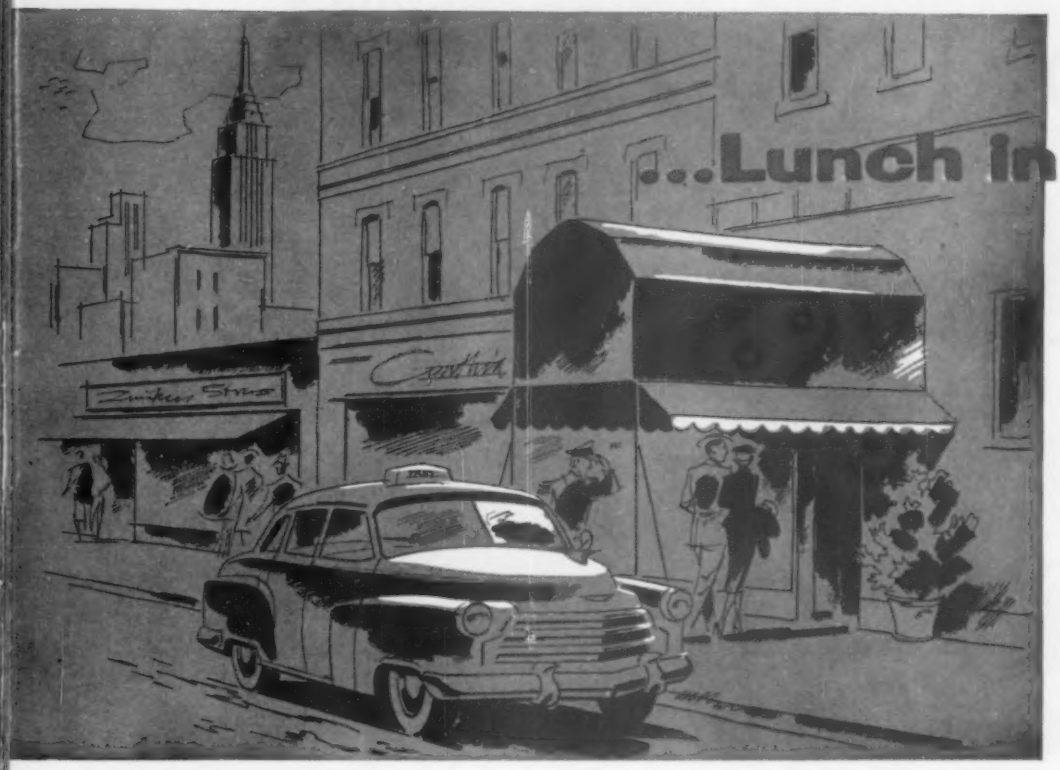
**Most passengers prefer American's delicious meals aloft.*



...Lunch in N.Y.

...Dinner in L.A.

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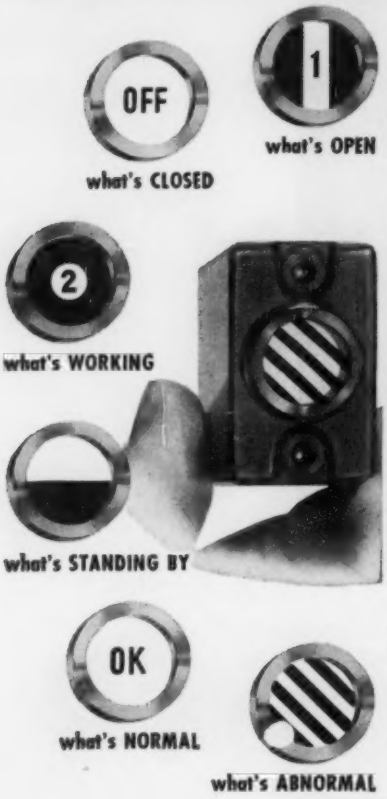

THE KEYSTONE 3-POSITION INDICATOR at present is being used on aircraft to report more than 60 operating situations. Simple, easy to read, hermetically sealed, reliable, it will report *any* variable that can actuate a switch mechanism.

Conforms to spec. MIL-I-6839, Landing Gear Position Indicator. Send coupon for complete information.

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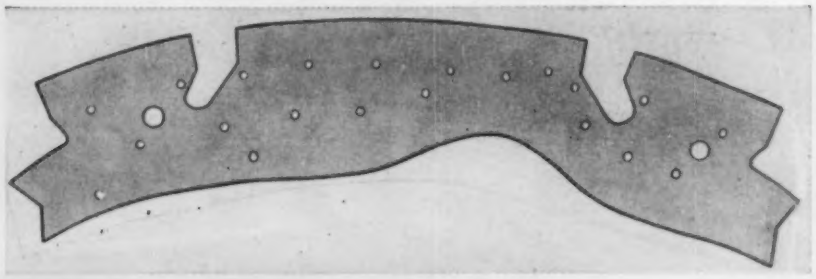
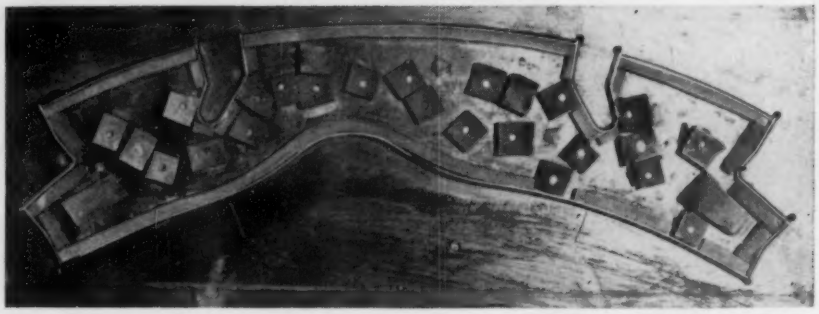




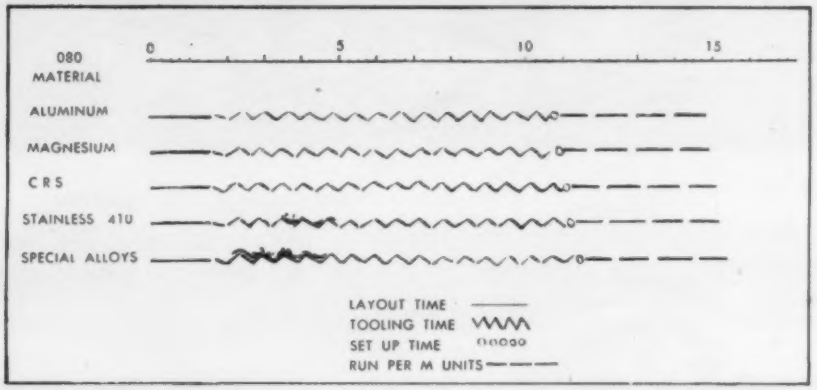


CHART SHOWS TIMES for layout, tooling, set up and running of typical part in various metals, using Templet steel rule dies. Aircraft part shown is .080-in. stainless steel, 17 in. in length.

dies cutting other metals.

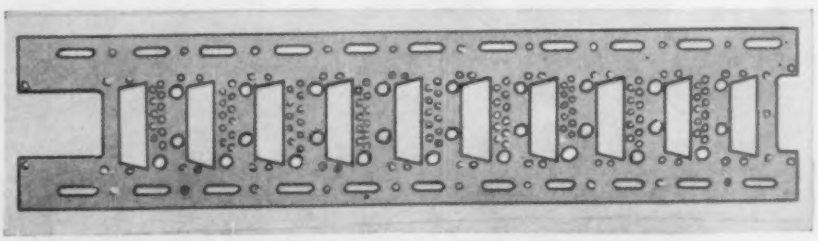
The TIP dies are adapatable to standard presses and will run at full stroke press speed.

Production of dies by the Templet Industrial Process is a fairly simple matter, and a diemaker can be trained in a couple of weeks. Templet offers, as part of its licensing agreements, 120 hours of instruction to the licensee. At the end of this time, the trainee will be fully qualified to produce TIP dies, the company says.

Templet expects this feature of its process to have great impact on the metal-working industry, alleviating the tight supply situation with regard to experienced tool designers and diemakers.

How TIP Die is Made

Briefly, this is how TIP dies are made: The desired pattern is laid out on a plywood block with a sharp stylus. A precision-cutting saw is used to slot the block, following the pattern layout, to make room for the steel die. This die consists of several strips of hardened steel, somewhat higher than



TIP-PRODUCED aluminum panel took 20 hr. from blueprint stage to stamping.

Rheem

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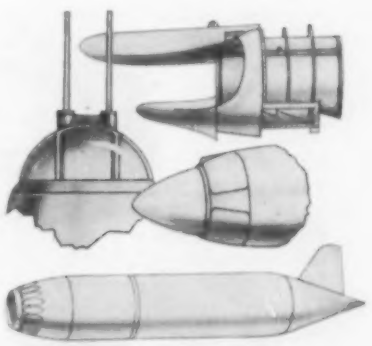
Just as the bold, firm signature of John Hancock signified full acceptance of the responsibilities contained in the Declaration of Independence, so does the Rheem signature, on a prime or sub-contract, signify full responsibility for every commitment to the most minute detail.

In every operation, from preliminary research through precision engineering to quality-controlled production, responsibility is a sacred trust at Rheem and is the key factor in Rheem's enviable record of low per-unit cost and on-time completion schedules.

The Government Products Division facilities of Rheem are presently in quality development and production on air frames, missile and jet-engine components, airborne ordnance, electronics and ordnance materiel.



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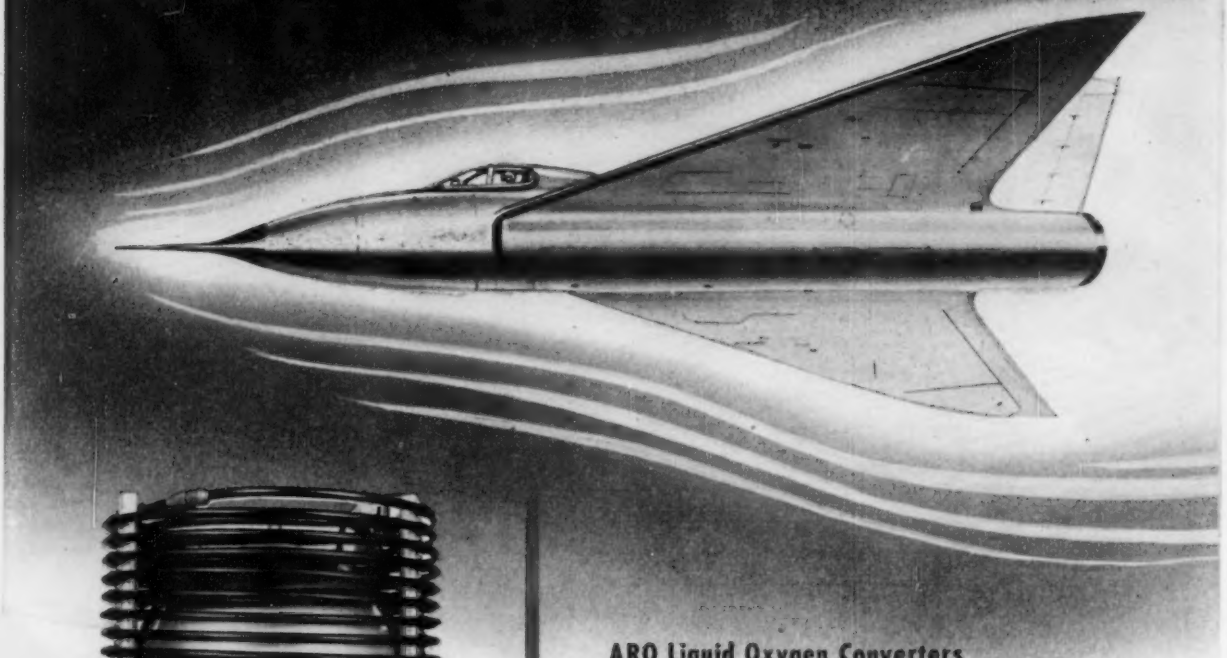
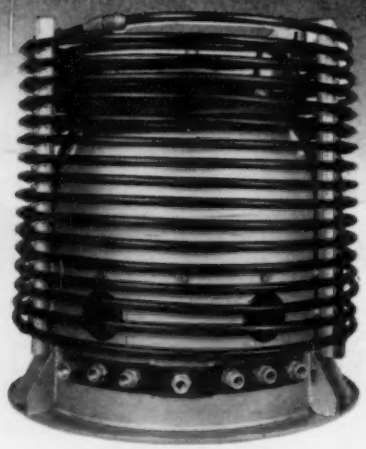
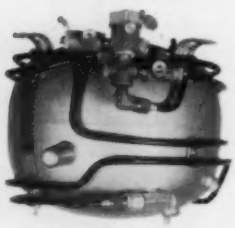




20 LITER CONVERTER



5 LITER CONVERTER

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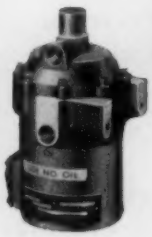

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make one tank of liquid do the job of many tanks of gaseous oxygen! This important forward step in oxygen supply is another ARO *first!*

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the plywood block. Their widths vary upward from .042 in., depending on thickness of and type of material to be stamped. The strips are cut and formed to the contours and lengths required by the pattern and inserted into the slots in the plywood block until their lower edges are flush with the bottom of the block. The shearing edges extend above the top of the block.

Where holes are desired in the formed part, steel dowels of the desired diameter are pressed into the block. Rubber ejector strips are cemented around the cutting parts.

Lawrence Rheingold, Templet's president, says the dies have been used for runs up to 100,000 pieces and have been in excellent condition when taken off. They store conveniently in vertical racks, taking up little room, and are ready to go back into immediate service when needed.

The TIP system not only produces dies in a far shorter time than customary methods, but allows considerable savings in production time. This is because setup time is shorter and, since resharpening of shearing face is quick and simple, press downtime for die replacement is cut drastically.

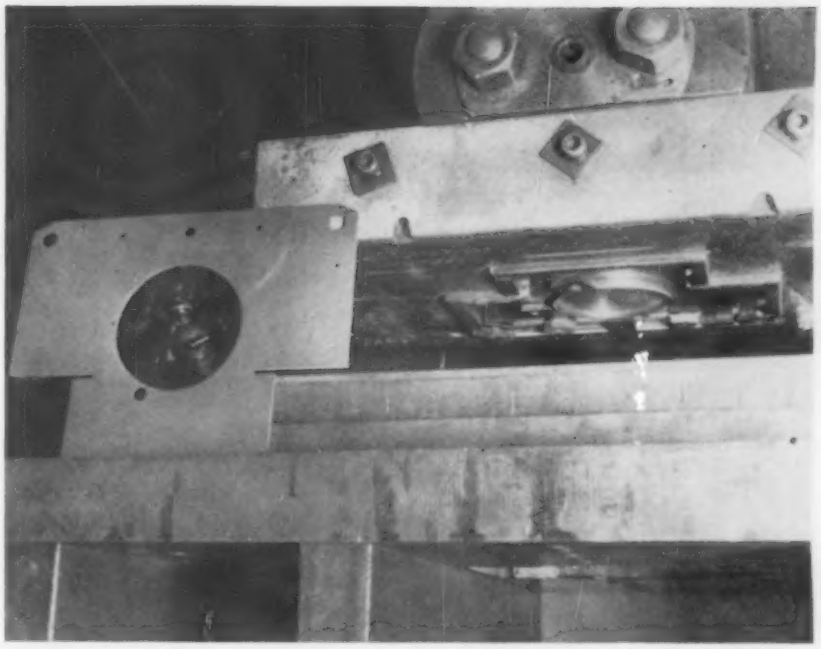
Templet says it is rare for total time from print to first acceptable part to exceed 35 man-hours, regardless of material, tolerances, etc.

Old Carton Trick

The Templet Industrial Process is an outgrowth of paper carton cutting practice, with which both of Templet's founders, Rheingold and vice president Milt Berlin, were familiar. It also has been widely used for cutting other non-metallic materials such as rubber and leather. Before World War II, Rheingold and Berlin had begun to adapt the process to metal stamping, blanking out early parts on a printing press.

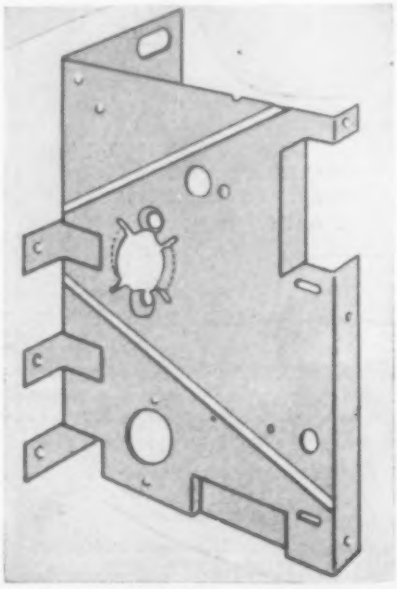
During the war, Berlin brought the possibilities of the process to the attention of his superiors in the Army and was eventually assigned to a Lockheed Aircraft facility in England and instructed to set up a shop using the method. In a short time a crew of less than 20 had replaced the original complement of close to 150 and the shop was turning out aircraft replacement parts in production quantities. Berlin received a citation from the Army Air Forces for this achievement.

After the war, the partners continued work on the process, refining it and extending its applications. Now the process is ready to go industrially, and I. H. McCaughey, formerly of Kaiser Metal Products, Bristol, Pa., has been appointed vice president-sales and service, to market the licensing arrangement. He had previously been with Piasecki and Ford.



TIP DIE MOUNTED on press ram. Standing at left is stainless steel part produced.

McCaughey says the low cost of Templet dies and the fast time from blueprint to production has often met with disbelief. McCaughey states that he himself was a scoffer when he was first introduced to the TIP technique while project manager of special military projects at Kaiser-Bristol. However, a study of the process convinced him of its value to the metal-working industry and he left Kaiser to take up his present position with Templet.



TIME FROM PRINT to part for this aluminum chassis was 31 hr. Two operations make it: 1) blank, pierce, lance; 2) emboss, form.

Assisting McCaughey is Charles Hazzard, formerly manager of subcontracts at Piasecki Helicopter Corp.

Licensing Arrangements

License fees are tied to gross sales. The minimum fee is $5,000 a year stepping up to a maximum cost of $10,000 for companies doing $1 million and over. If the prime licensee runs a multi-plant operation, he may get secondary licenses for other tooling or stamping centers at an additional fee of 25% of the prime license for each center.

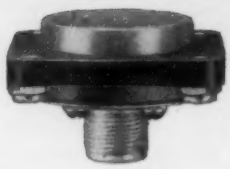
McCaughey says the firms which have expressed interest in the Templet process read like a Who's Who of the metal-working field. In addition to Republic, the aviation industry companies include Ford's Aircraft Engine Div., McDonnell, Piasecki, Kaiser-Bristol, RCA, Bendix, Heintz Mfg. Co., E. G. Budd Mfg. and American Pulley Co.

The Templet parent company will continue to operate as a sheet metal job shop. This is necessary, Rheingold says, to provide licensee trainees the opportunity of working on actual industrial problems as they come up. It will also enable the company to keep abreast of new requirements in the field, and adapt the process to them. Templet's job shop has about 40 industrial presses of various types.

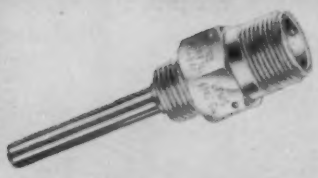
Templet, has been doing a half-million-dollar annual business at its present plant, 160 Flushing Ave., Brooklyn, N. Y. Management is now studying relocation and expansion of its facility.

Delavan . . . designer and manufacturer of fuel nozzles for Pratt and Whitney Aircraft's J57 Turbojet, powering the Douglas F4D Skyray. Delavan has brought unprecedented nozzle performance to the aircraft industry.
DELAVAN Mfg. Co.
GRAND AVE. AND FOURTH ST • WEST DES MOINES, IOWA

STURDY, FAST ACTING RESISTANCE BULBS BY **LEWIS**

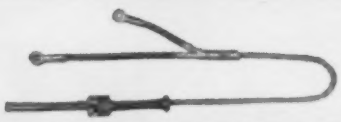


FREE AIR TYPE, MS28038-1 to MIL-B-8598

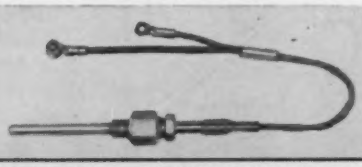


THREADED, PROBE TYPE MS28034-1 and MS28034-2 to MIL-B-7990

CYLINDER HEAD, BAYONET TYPE AN5546-1 to MIL-B-5491



PROBE TYPE, WITH ADJUSTABLE STAINLESS STEEL STUFFING-GLAND



FOR DEPENDABLE TEMPERATURE MEASUREMENTS, USE LEWIS BULBS WITH LEWIS RESISTANCE THERMOMETERS.

the LEWIS ENGINEERING COMPANY
naugatuck, connecticut

Navy Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Navy Contracting Offices:

BUREAU OF AERONAUTICS, Washington 25, D. C.

Avco Mfg. Corp., Lycoming Div., Stratford, Conn., constant speed power transmissions, 3 ea., $251,707.

Greer Hydraulics, Inc., N. Y., International Airport, Jamaica 30, N. Y., universal jet engine fuel control test stands, 4 ea., $372,288; universal linear actuator test stands, 8 ea., $71,864.

Aerosonic Instrument Corp., 528 Reading Road, Cincinnati 2, Ohio, pressure altimeters, 501 ea., $38,185.

E. W. Bliss Co., 1375 Raff Rd., S. W. Canton 10, Ohio, catapult, shore based, spares, type C, mark 7, mark 11, model 1, various, $542,617.

Willard Aircraft Service Equip., Inc., 2963 N. W. 79th St., Miami 47, Fla., engine servicing platforms for model R4Q aircraft, 30 ea., $120,600.

Loral Electronics Corp., 794 E. 140th St., New York 54, N. Y., navigation computers, electric control amplifiers and related equipment, 944 ea., $9,333,149.

Aeroflex Labs., Inc., 34-06 Killman Ave., Long Island City 1, N. Y., ART-14 Torquerol mounts for use with CA-12 cameras, 10 ea., $125,000.

Kollsman Instrument Corp., 80-08 45th Ave., Elmhurst 73, N. Y., rate of climb indicators, 1,885 ea., $158,832.

Industrial Engineering Corp., 525 E. Woodbine St., Louisville 8, Ky., universal rotary actuator and power unit test stands, 8 ea., $92,941.

Aircraft Radio Corp., Boonton, N. J., test kits and calibrators, 259 ea., $101,181.

Jam Handy Organization Inc., 2821 E. Grand Blvd., Detroit 11, Mich., preparation of master shooting scripts and production of training films, job, $47,419.

Van Zelm Assoc., Inc., 7803 Pulaski Hwy, Baltimore 6, Md., AT-3 catapults, 7 ea., $343,718.

Dayton T. Brown, Inc., 1305 Strong Ave., Copiaque, L. I., N. Y., conduct production lot sample testing for quality control of armament equipment, job, $349,542.

W. L. Maxson Corp., 460 W. 34th St., New York 1, N. Y., Aero 2D gunsight controllers, 634 ea., $307,706.

Glenn L. Martin Co., Baltimore, Md., kits of parts to modify Whittaker fuel shut-off valves, 1,768 ea., $56,610.

Sperry Gyroscope Co., Great Neck, L. I., N. Y., amplifiers, compensators, controllers, indicators, flux valves, various, $187,393; phase adapters, 33 ea., $682,752; gyro horizon indicators, 1,545 ea., $1,272,937.

Lockheed Aircraft Corp., Burbank, Calif., universal jet engine handling dollies, 180 ea., $1,203,358.

Wright Aero Div., Curtiss-Wright Corp., Caldwell, N. J., overhaul government-owned R3350-75 engines and modify to latest WAD modification, 8 ea., $150,796.

Hewlett-Packard Co., 275 Page Mill Road, Palo Alto, Calif., frequency converters, 176 ea., $53,508.

Boonton Radio Corp., Boonton, N. J., pre-production and production models of AN/ARM-24 signal generators, 36 ea., $210,333.

General Electric Co., 1 River Road, Schenectady, N. Y., TBA MA-1 compass electrical test bench mockup with components, 45 ea., $588,223.

Herrick L. Johnston, Inc., 540 W. Poplar Ave., Columbus 8, Ohio, complete one government-owned ex-Air Force 750-liter liquid hydrogen container for transportation service as 750-liter liquid helium container, $35,200.

Friden Calculating Machine Co., Inc., San Leandro, Calif., repair tools, test equipment and measuring devices, various, $63,125.

Belmont Iron Works, 22nd and Washington Ave., Philadelphia, Pa., furnish and assemble Mitchell Mobilhangar, job, $126,371.

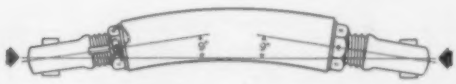
ANNOUNCING

the new BALANCED-DESIGN SERIES of FAFNIR ROD END CONTROL BEARINGS

High capacity roller type for power-operated control systems
Ball bearing rod ends with high-strength shanks for manually operated control systems

A Complete Family of 5 sizes

Designed specifically with bearing capacity, shank strength, and bolt strength all in balance, the new Fafnir series of rod ends is the direct result of an NASC study in which Fafnir engineers participated. Every member of this rod end family is completely new, carefully engineered and tested. Together, they represent the first series of rod ends developed with a significant relationship between bearing capacity, shank and bolt strength. What's more, Fafnir Balanced Design Rod Ends are made to withstand column action under compression with angularity as high as 9°.



Even the shank threads of the new rod ends are precision rolled with rounded roots to assure maximum strength and fatigue life.

A Special Bulletin is available that fully describes design and constructional advantages . . . also shows dimensions and load-life ratings. FOR PROMPT RESPONSE ask for Balanced Design Rod End Bulletin. The Fafnir Bearing Company, New Britain, Connecticut.

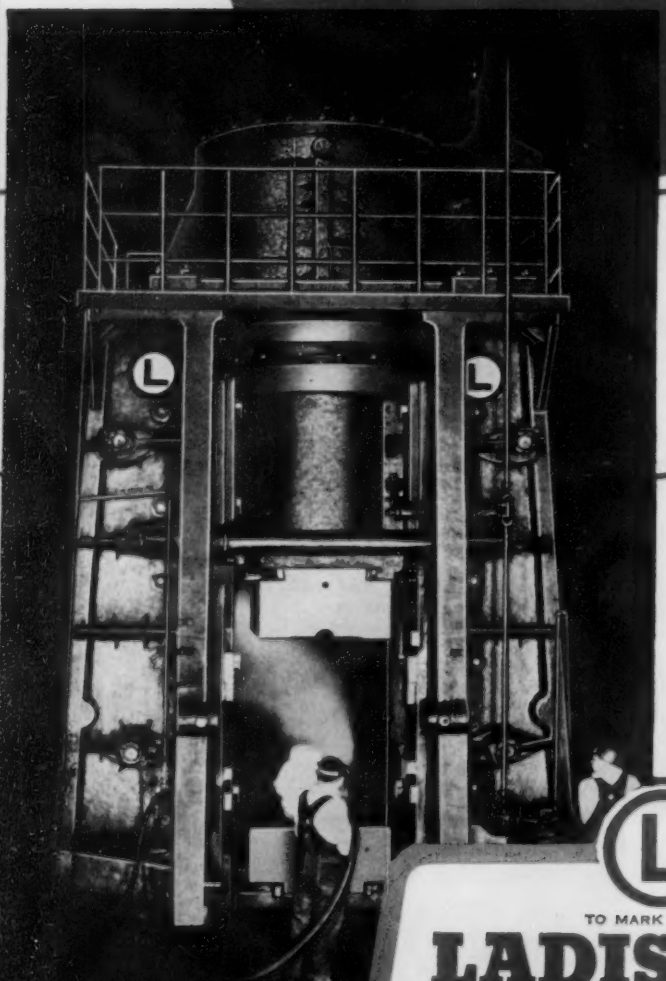
FAFNIR

AIRCRAFT BEARINGS

"FIRST . . . at the turning points in aircraft design"

LADISH

OFFERS GREATER LATITUDE IN THE DESIGN OF LARGE COMPLICATED PARTS



WORLD'S LARGEST FORGING HAMMER

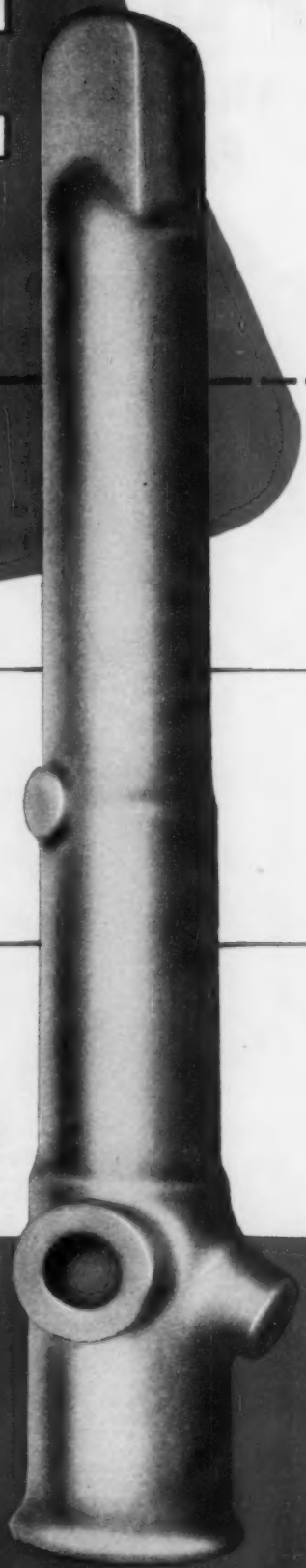
80,000 MKG counterblow forging hammer, the most powerful known in the world, is estimated to be equivalent to 100,000 pound one way steam drop hammer if such were available.

TURBINE BLADES

Forged by Ladish in Titanium and Stainless Steel Alloys to withstand tremendous pressures and temperatures without deformation.

LANDING GEAR

Outstanding example of Ladish heavy drop forgings: 8500 pounds, 132 inches in length. Drop Forging saved material and machining cost for 5000 pounds of Chromium-Nickel-Molybdenum alloy steel.



TO MARK PROGRESS

LADISH CO.

CUDAHY, (Milwaukee Suburb) WISCONSIN

Controlled Quality

DROP FORGINGS UP TO 10,000 POUNDS,
WELDED AND SEAMLESS ROLLED RINGS UP TO 60,000 POUNDS

REGARDLESS OF SIZE, CONTOUR OR MATERIAL...YOU CAN DEPEND ON LADISH

Ladish pioneering in tremendous closed-impression-die forgings offers engineers new freedom in extending the inherent advantages of the drop forging process to intricately shaped parts weighing as much as *10,000 pounds*. Drop Forging close-to-finish dimensions materially reduce metal and machining costs . . . while improvement in dynamic strength and toughness makes possible substantial reductions in dead weight . . . and higher factors of safety.

A discussion of your products with a Ladish forging engineer will provide specific data on the ultimate economy and improvement in design you can impart to your own products by specifying forgings . . . Ladish Controlled Quality forgings.

WITH CLOSED-IMPRESSION-DIE DROP FORGINGS WEIGHING UP TO 10,000 LBS.

TITANIUM PROPELLER BLADE

Again Ladish pioneers with the largest known Titanium forging produced in closed-impression dies. 40% saving in weight realized by forging this 100-inch blade in "wonder metal" Titanium.

DIESEL CRANKSHAFT

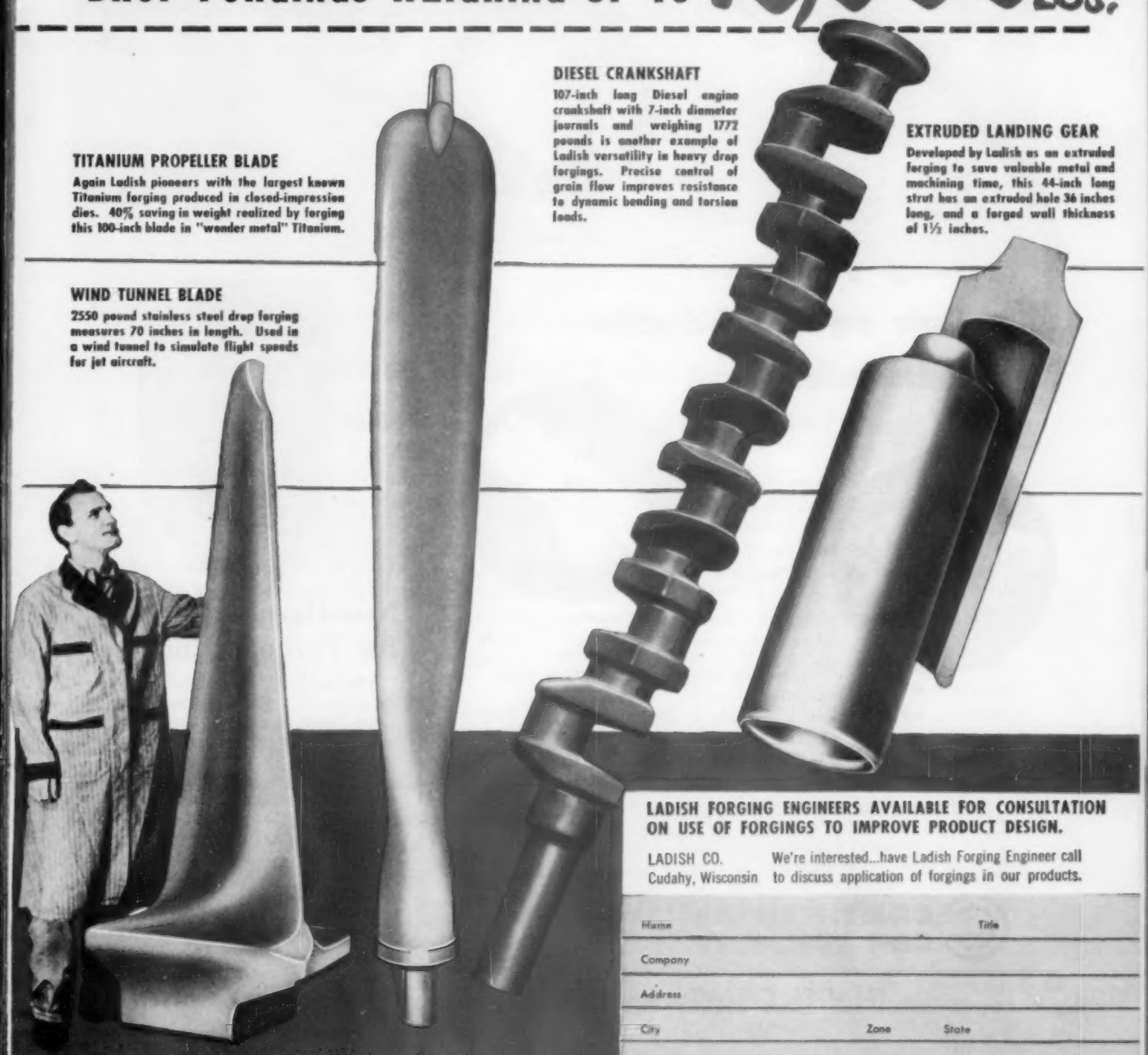
107-inch long Diesel engine crankshaft with 7-inch diameter journals and weighing 1772 pounds is another example of Ladish versatility in heavy drop forgings. Precise control of grain flow improves resistance to dynamic bending and torsion loads.

EXTRUDED LANDING GEAR

Developed by Ladish as an extruded forging to save valuable metal and machining time, this 44-inch long strut has an extruded hole 36 inches long, and a forged wall thickness of 1½ inches.

WIND TUNNEL BLADE

2550 pound stainless steel drop forging measures 70 inches in length. Used in a wind tunnel to simulate flight speeds for jet aircraft.



FOR COMPLETE SERVICE IN FORGINGS

LADISH FORGING ENGINEERS AVAILABLE FOR CONSULTATION ON USE OF FORGINGS TO IMPROVE PRODUCT DESIGN.

LADISH CO.
Cudahy, Wisconsin

We're interested...have Ladish Forging Engineer call to discuss application of forgings in our products.

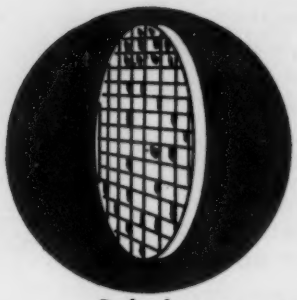
Name Title

Company

Address

City Zone State

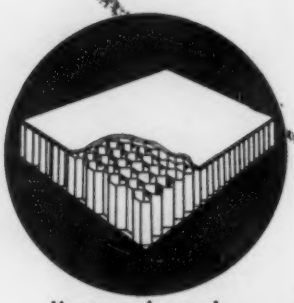
Our Products AW



Radar lens

Landing gear doors

Let Continental help you meet "air age" production schedules



Honeycomb panels

Flaps

Are overloaded shops or processing problems threatening your production schedules? Remember, Continental is equipped and ready to take these worries off your mind. As producers of a complete line of aircraft components, Continental has both the skill and facilities to give you top quality work—on time.

Why not put our skilled technicians, and production know-how, to work for you. They're available now. Write, wire or phone Howard Bilderback, Mgr. Sales Engineering, at address below.

CONTINENTAL CAN COMPANY

PLANT 95 Coffeyville, Kansas

Three New Regulators Manufactured by Aro

The Aro Equipment Corp. of Bryan, Ohio, has announced the production of three new pressure regulators and a relief valve for aircraft. They are:

• **Absolute pressure regulator.** Model 12275, for electronic equipment containers, uses engine-bleed air or other dry gases. Operating at an inlet pressure of 35 to 250 psi., the instrument has a flow of up to 10 liters per min. and can be calibrated to meet specific aircraft applications.

• **Air pressure regulator.** Model 13200, for regulating compressor bleed air to external fuel tanks, operates without overboard bleed or external leakage. Suitable for use with air, it is not affected by fuels MIL-F-5624, MIL-H-3136, or MIL-F-5572 in any sequence.

• **Pressure relief valve.** Model 13300 maintains external fuel tank pressure within required limits. Suitable for use with dry air, it is not affected by fuels MIL-F-5624, MIL-H-3136 or MIL-F-5572 in any sequence. Manufacturer reports that the valve operates at 50 psi. without external leakage.

New Harness Tester for Turbojet Engines

The universal harness tester shown above has been placed on the market by Greer Hydraulics, Inc., located at International Airport in Jamaica, N. Y.

The tester provides a quick and accurate check of continuity, insulation resistance, interlead shorts and shorts-to-ground in the electrical control harness of turbojet engines.

The device consists of a low and high voltage test circuit, switches and controls for applying these potentials to the cable being tested and lights which indicate proper or faulty operation. The tester uses a 110-v., 60-cycle, single-phase power source and has no mechanical parts.

Order your size of TIMKEN® 52100 steel tubing today—we'll ship from mill stock tomorrow!

101 sizes of Timken® 52100 steel tubing are available in mill stock to take care of your rush hollow parts jobs. Order your size in less-than-mill quantities today, and we'll ship within 24 hours.

Timken 52100 steel tubing is excellent for most of your high quality hollow parts jobs. It's a through-hardening steel in moderate sections. It can be heat treated to file hardness and tempered back to any desired point. And it can be used in place of more expensive steels.

Available in sizes from 1″ to 10½″ O.D., Timken 52100 steel is used for hollow parts jobs like these: aircraft parts, ball bearing races, pump parts and plungers, collets, bushings, spindles, grinding machine parts, precision instruments, and dozens of other jobs.

The Timken Company is America's pioneer producer of 52100 tubing. And we're the only company that makes 52100 steel in tubing, bars and wire. Our unequaled experience assures you of uniform quality from tube to tube and heat to heat.

For immediate delivery of your less-than-mill quantity orders, write, wire or phone The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

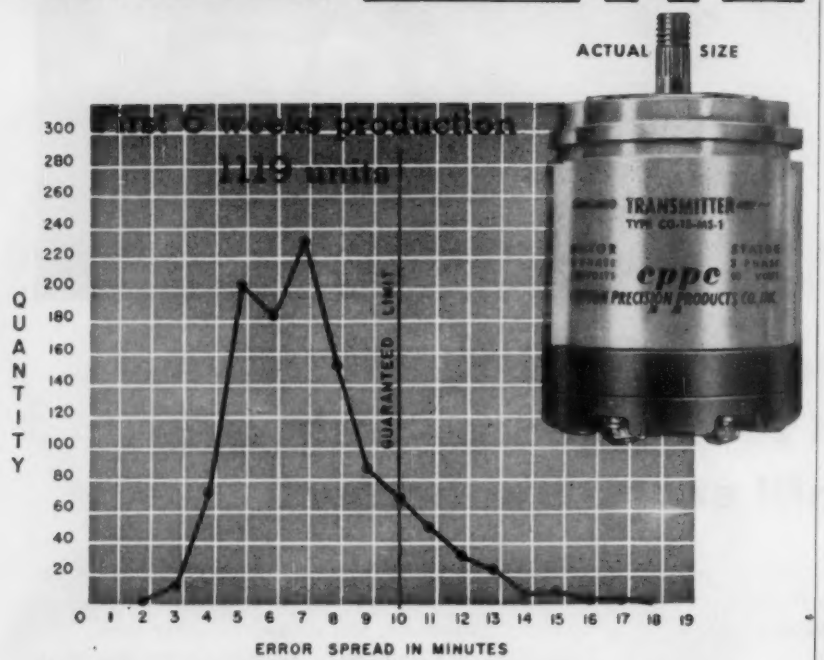
SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

CLIFTON PRECISION OFFERS A SIZE 15 SYNCHRO TRANSMITTER

identical to BuOrd type 15CX4a

Except

ACCURACY SPREAD GUARANTEED 10′ or LESS



The CG-15-MS-1 transmitter is interchangeable part for part with the U.S. Navy Bureau of Ordnance type 15CX4a synchro transmitter (Mark 22 Mod. 1) in every respect.

Because of quality workmanship in this unit we are able to guarantee accuracy spreads not to exceed 10′. From the chart it will be noted the majority of production units have error spreads between 5′ and 8′—yet price remains exceedingly low.

Stainless steel bearings are provided for better environmental resistance.

FOR SALES INFORMATION, CONTACT:

New England: The Darbury Corp., 99 Elm St., W. Newton 65, Mass.
Southwest: Ammon & Woods Asso., 4163 Glenwick Lane, Dallas, Tex.
West Coast: Enright Engineering Co., 988 W. Kensington Rd., Los Angeles
Home Office: T. W. Shoop, Sales Mgr., Telephone (Phila.) MAdison 6-2101

LOOK TO CPPC FOR SYNCHRO PROGRESS

CLIFTON PRECISION PRODUCTS CO. Inc.

CLIFTON HEIGHTS
PENNSYLVANIA

cppc

PRODUCTION BRIEFING

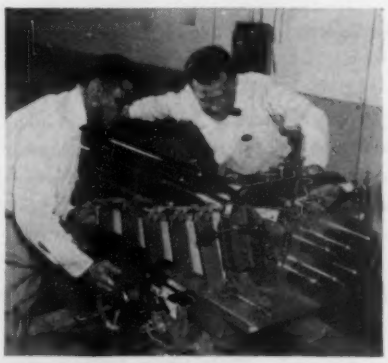
▶ **Barry Controls Inc.,** Watertown, Mass., has licensed Fritz Brumme, Hermannstrasse 7-11, Raunheim, Germany, to produce and sell its products. Among the products to be produced in Germany are isolators for mobile electronic instruments and Leveling Barrymounts, self-leveling machinery mounts.

▶ **Stratos Div.** of Fairchild Engine & Airplane Corp. will establish a commercial products plant in October in Babylon, L. I., N. Y. Products to be manufactured will include pneumatic controls, valves.

▶ **Van der Horst Corp.** will establish plant facilities in Chicago. The new plant will provide for a 48,000-amp. hour plating capacity. Production is expected to start early in 1956.

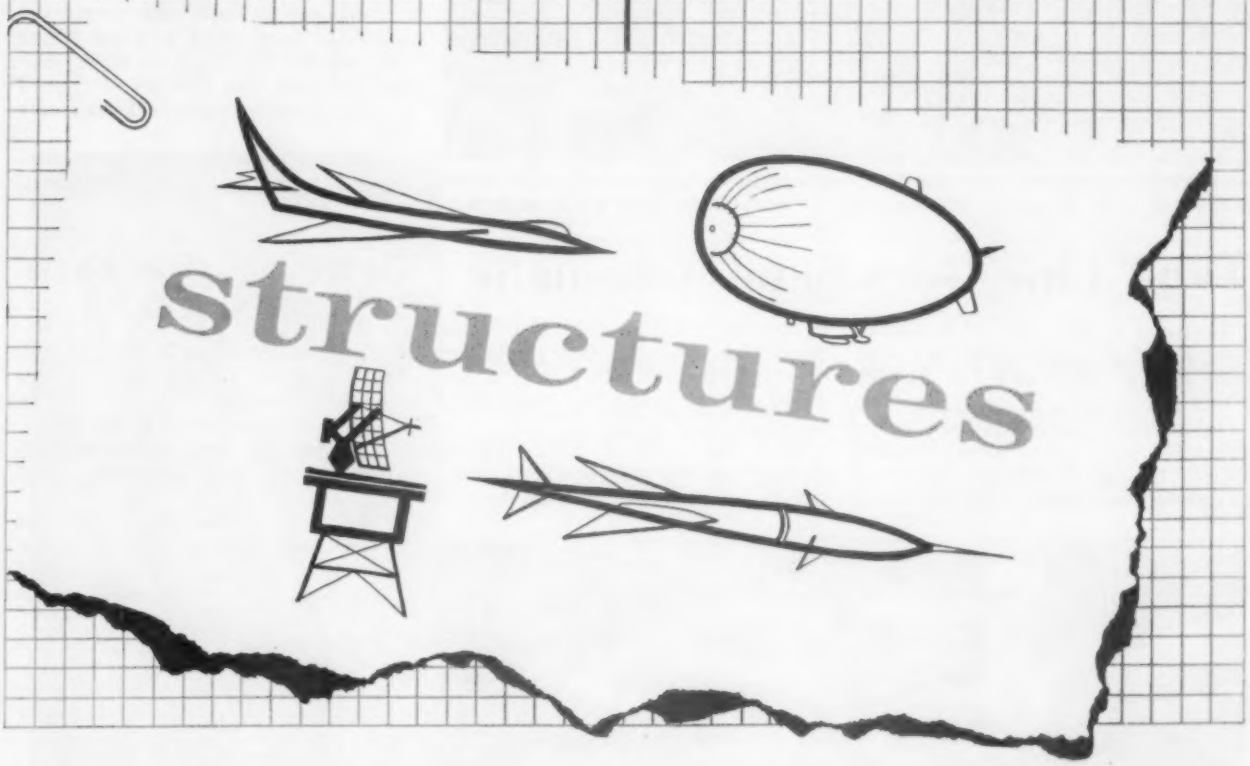
▶ **Fielden Instrument Division,** Robertshaw-Fulton Controls Co., has opened a western regional sales engineering office at 3101 Imperial Highway, Lynwood, Calif., under the supervision of Charles J. O'Lone.

▶ **Gordon Enterprises,** North Hollywood, Calif., has been awarded exclusive representation of Photo-Sonics data recording cameras. Now used at White Sands, Naval Air Missile Test Center, the Air Force Flight Test Center, NOTS, Invokern and other military activities, the specialized Photo-Sonics cameras have been used in aeronautical research and development since their introduction a year ago.



MULTIPLE-SPINDLE semi-automatic boring fixture, occupying 12 sq. ft. of floor space, has reduced drilling time on a concave, difficult-to-machine casting from 10 hours to 45 minutes at Northrop Aircraft, Inc. Built to Northrop specifications by the Angle Computer Co., Glendale, Calif., for drilling the rocket pod orifice holes for the F-89 Scorpion, the machine makes both rough and finish cuts in a single pass of the boring bars.

Engineering | Design
Research | Development



Structural engineers will find real scope and diversification at Goodyear Aircraft—where completely new aircraft configurations, utilizing a host of new weight-saving materials, are among the interesting assignments.

Here is an opportunity to work with Goodyear-built plastic laminates and bonded sandwich structures – to explore new avenues of approach to structural design through the services of the Goodyear-built analog computer laboratory, one of the largest in the world.

In virtually any engineering specialty, a challenging and bright future awaits creative men who come to Goodyear Aircraft—where missiles, jets, helicopters, airships and radar structures take shape.

We invite you to send a resumé or write for an application blank. Address:

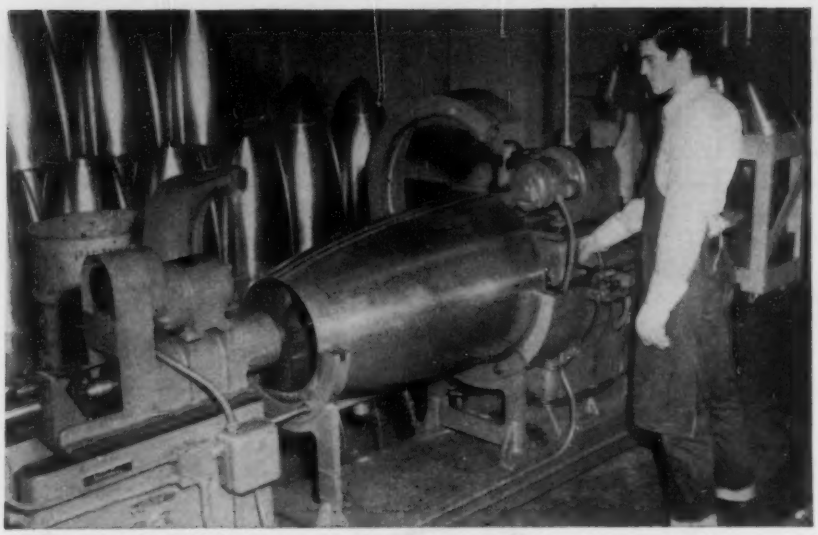
C. G. Jones, Personnel Department, Goodyear Aircraft Corporation, Akron 15, Ohio.

Plants in Akron and Litchfield Park, Arizona.

They're doing big things at

GOODYEAR AIRCRAFT

THE TEAM TO TEAM WITH in AERONAUTICS



AUTOMATIC MACHINE locates and trims both ends of forward section to diameter and length and drills drain hole. Operator may be unskilled; he loads and unloads only.

Tank Line Goes Semi-Automatic

Pastushin Aviation has set a production rate of one jettisonable fuel tank every 4 min. for its new Los Angeles plant.

To achieve this rate, the facility will make wide use of semi-automatic special tooling, handling equipment and gaging and machine controls. Tank sections are rolled into conical or cylindrical shapes in the first production operation, then conveyed to the line welder which makes the longitudinal seam.

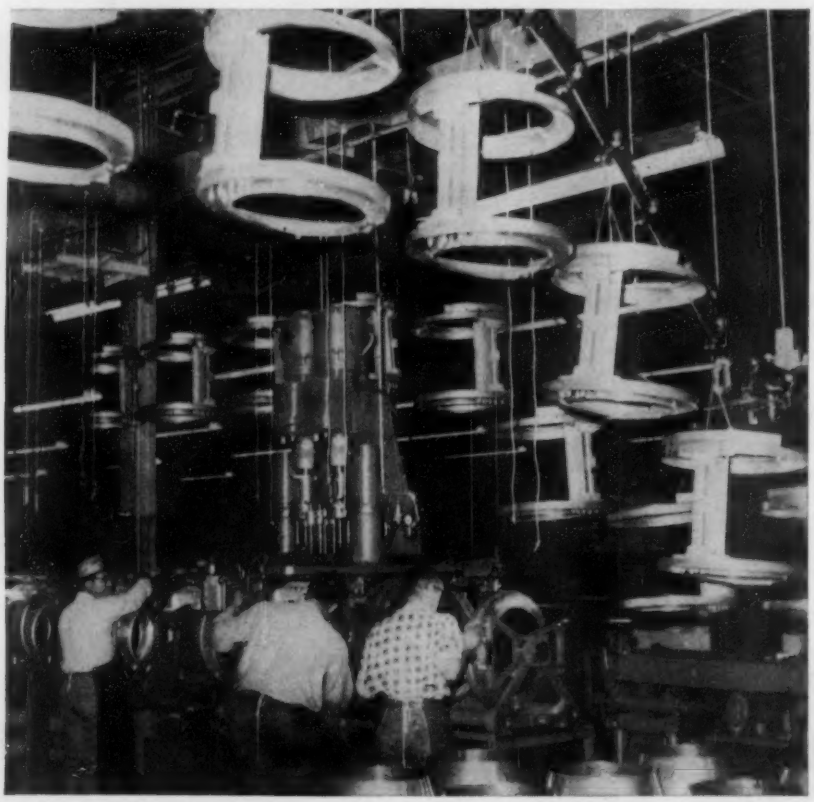
After the weld is rolled flat to produce uniform thickness, the center section goes to a sub-assembly area where bulkheads and internal structures are installed; tail and nose sections go to bulge forming machines.

Nose and tail skins are trimmed on special machines to produce true surfaces for the subsequent joining operation.

Then sheet metal spinnings for the nose and tail cones come to the line where automatic Heliarc machines weld them to nose and aft sections. After two special welding machines join aft and center sections, tanks are ready for a pressure check, crating and shipment—27 tanks to a truck.

Parts such as bulkheads, intercostals and other sheet metal, cast and forged parts are fabricated outside the special assembly area and then are stockpiled in store rooms adjacent to the assembly line.

The new assembly facility employs about 50 men, working in a 50x100-ft. area.



BULKHEADS AND UPPER INTERCOSTAL are assembled on rolling fixtures. Four holes are accurately drilled simultaneously in the assembly to mate with the support casting.

Hydrant System Fuels B-52s at Seattle

USAF B-52 bombers at Boeing Field, Seattle, can be refueled from hydrants four at a time in what may be the world's largest and fastest filling station.

Fuel for the eight-jet bombers is stored in three 40,000-gal. underground tanks.

Three 75-hp. pumps can push the jet fuel through filters and water separators at 1,200 gpm into a manifold which serves all the ground-level hydrants.

Fuel flow, which can be reversed, is pushbutton controlled. Rows of water-fog nozzles are set just below the level of the concrete to prevent the spread of fire.

USAF Gets First Supersonic Simulator

The Air Force has gotten its first flight simulator for a supersonic plane, with delivery to Nellis AFB, Nev., of a unit for the North American F-100A Super Sabre. A second unit will be delivered soon.

Several simulators for Convair's supersonic F-102A are slated for early installation at Tyndall AFB, Fla. (AW July 4, p. 69).

The F-100A simulator was developed by Melpar, Inc., Alexandria, Va., under supervision of Wright Air Development Center's Equipment Lab.

It required 18 months to complete the simulator from the initial design through final construction.

The unit's weight is 11 tons.

It takes 18.5 kw. of power to run, and includes 4.5-ton air conditioning capacity.

NEW SAGINAW b/b SCREW LAUNCHES A PROGRAM OF UNPARALLELED WEIGHT REDUCTION AND RELIABILITY IN . . .

GUIDED MISSILE ACTUATION!

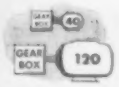
EXCLUSIVE FAIL-SAFE MULTIPLE CIRCUITS
If one circuit should fail, the rest will function without interruption, sharing load between them.

Two of the most critical problems facing R & D engineers are (1) peeling needless pounds off hardware and (2) achieving near-perfect reliability of guidance equipment. That's why they're placing more and more reliance on Saginaw's *Safety ball/bearing Screw* for vital actuation jobs. Free from the limitations of both inefficient Acme screws and bulky hydraulic systems, the *Safety b/b Screw* will function dependably under "impossible" conditions.

Units have been built from 1½ inches to 39½ feet long. Each is individually engineered for its particular application, with the know-how that only Saginaw, *the pioneer producer*, can offer you. Our engineers are ready and eager to help solve your missile actuation problems—*now!*

WHY THE SAFETY b/b SCREW BELONGS IN YOUR MISSILES:

SPACE/WEIGHT SAVINGS INCREASE SPEED AND RANGE



Compared to either Acme screw or hydraulic actuators, the *Safety b/b Screw* saves significant weight and space by permitting the use of smaller motors and gear boxes; eliminating pumps, accumulators, piping, etc.

PERFECT PERFORMANCE AT EXTREME TEMPERATURES

Exhaustive laboratory tests prove that the *Safety b/b Screw* operates dependably at both extremely low and high temperatures, ranging from —90° F to +900° F—within limits of most interior missile environments.

POSITIVE POSITIONING AND SYNCHRONIZATION

Unlike some other types of actuators, the *Safety b/b Screw* permits precision control within thousandths of an inch, plus perfect synchronization of two or more movements—a tremendous boon to aircraft engineers.

FAR LESS DRAIN ON ELECTRICAL SYSTEM

By requiring only 1/3 as much torque as a conventional Acme screw for the same amount of lineal output, the *Safety b/b Screw* allows the use of much smaller motors, which save a substantial amount of power.

DEPENDABLE OPERATION DESPITE LACK OF LUBE

Because the *Safety b/b Screw* is inherently so friction-free (operating at 90% to 95% efficiency) it will function with only a small loss of efficiency *even if lubrication fails or cannot originally be provided*—a vital advantage.

GREATLY DECREASED COMBAT VULNERABILITY

By eliminating highly vulnerable hydraulic lines, accumulators, etc., the *Safety b/b Screw* makes guided missile actuation far more dependable. It also reduces maintenance due to its decreased sensitivity to dirt.

SEND TODAY FOR YOUR FREE ENGINEERING DATA BOOK

(or see our section in Sweet's Product Design File)

Saginaw Steering Gear Division
General Motors Corporation
Dept. 108, Saginaw, Michigan

Please send your Engineering Data Book to:

Name—Title_____

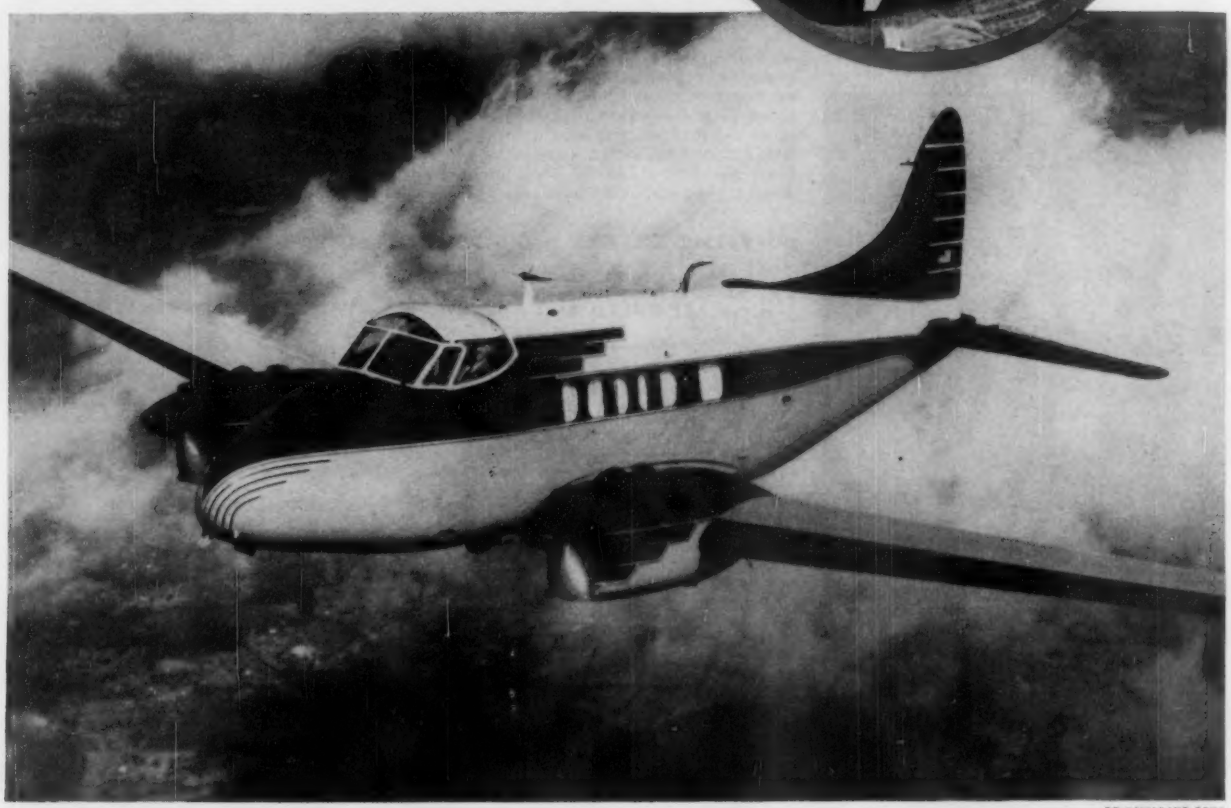
Firm_____

Address_____

City_____ Zone____ State_____

Safety ball bearing Screw by Saginaw

Moving the conference table 800 miles



DE HAVILLAND DOVE

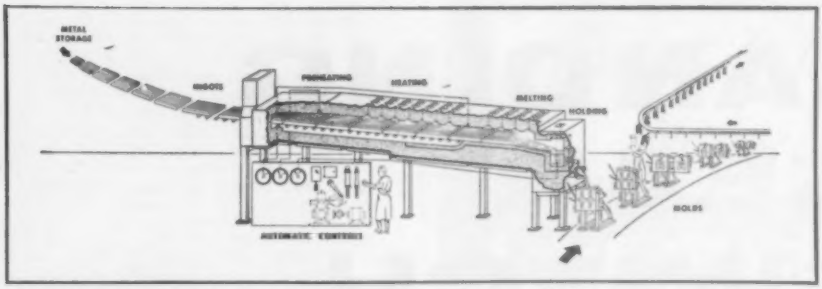
When the management group of the R. Company confronts important problems of production at one of their plants 800 miles away, they go right to the plant concerned. They can best solve the problems right on the spot. Their company plane gets them there fast, comfortably, and free of restricting schedules.

They will land at one of over 600 Esso Dealer Airports. Their pilot will produce his Esso Aviation Credit Card, which entitles the company to charge high quality Esso Aviation fuels and lubricants, tire and battery service, landing fees, overnight storage in transit, and minor emergency repairs.

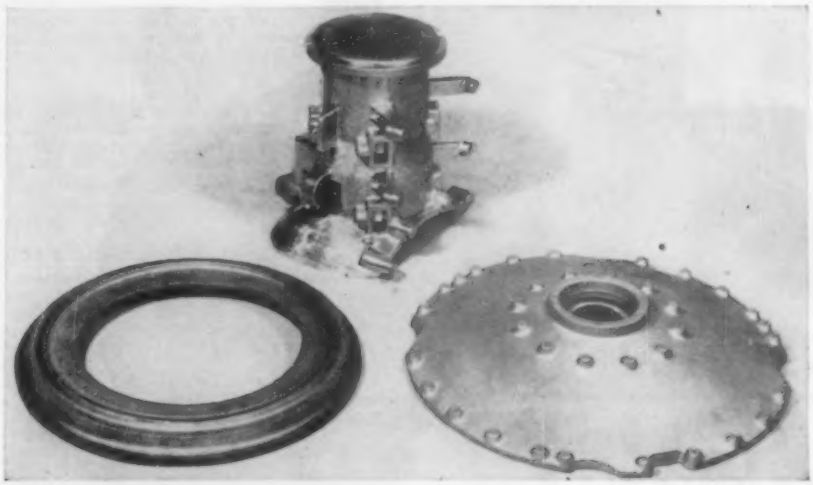
Business and pleasure flyers are learning more and more to depend on Esso Aviation Products — used by the world's largest airlines and backed by over 45 years of flight testing and research.

ESSO

AVIATION PRODUCTS



CONTINUOUS MELTING FURNACE produces aluminum for permanent mold castings.



INFLIGHT REFUELING MECHANISM (back) and seal ring and cover (front) for jet engine components are typical aluminum parts cast by permanent mold process at Monarch plant.

New Furnace Improves Castings

Continuous automatic in-line melting of aluminum alloys for casting may prove to be an important advance in the permanent mold method of casting aluminum.

A new tunnel furnace design which uses radiant gas burners operating at high temperatures to effect fast, controlled heat transfer, is said by its manufacturer to eliminate wasteful heating of heavy furnace equipment and large reserves of molten aluminum. The design has been in operation on a production basis for the last year at The Monarch Aluminum Manufacturing Co., Cleveland.

John H. Keating, Monarch's vice-president in charge of manufacturing, cites there advantages of the new system:

• **Quicker start-up.** Pouring temperature can be reached in less than three hours. Conventional reverbatory furnaces of the same capacity (1,500 to 3,000 lb.) take about 24 hours.

• **Reduced fuel costs.** Performance records show 1.9 cubic ft. of gas consumed per lb. of aluminum melted with the new process against 3 cubic ft. per lb. using the old method.

• **Better production scheduling.** Hot weather shutdowns are avoided since heat reduction makes it possible for a worker to operate furnace indefinitely without discomfort.

• **Less labor turnover and training costs.** Continuous employment and better working conditions have resulted from heat reduction.

• **Insured quality control.** Casting of the same analysis as the ingots from which they are poured are reproducibly uniform from casting to casting. Intermediate alloys can be obtained by mixing ingots of different compositions or sizes in the same charge.

As applied at Monarch, the relatively small tunnel furnace slopes downward from the input to the output end. Oxide-coating ingots are loaded at the upper end and automatically pushed lengthwise under a roof of radiant burners. The melting rate and pouring temperature are controlled by regulating the speed of ingots through the furnace and the fuel input to the burners.

The molten aluminum flows continuously through an opening near the lower end of the furnace directly into a pouring ladle. The cycle from cold ingot to liquid takes from 24 to 30 minutes.

Combustion products provide preheat during the first two-thirds of ingot travel; sixty burners provide a radiant roof 10 ft. long and 3 ft. wide over the final one-third. The short heat cycle does not hold the aluminum liquid long enough for much dross to form and keeps gas absorbtion at a minimum.

The new type furnace was jointly engineered by Monarch and the Selas Corp. of America, Philadelphia heat processing engineers. Selas will build continuous melting furnaces for foundries working in aluminum and other low-melting-point alloys.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Air Force Contracting Offices:

SHELBY AF DEPOT

Seymour Wallas & Co., 1200 S. 8th St., St. Louis, coveralls, flying, anti-G, sage green, type MB-2, 1,553 ea., (IFB 33-602-55-174B), $85,415.

South Western Gear Works, 117 North Palmer St., Houston 3, Tex., Bar, pry, wheeled, self-propelled, 28-v. d.c., type MB-1, 24 ea., bar, pry, wheeled, self-propelled, 110-v. a.c., type MB-2, 24 ea., $36,015.

Piasecki Helicopter Corp., Morton, Pa., parts for H-52 acft., (MIPR 6006, 6015, 6772), 193 ea., $26,892.

Blue Anchor Overall Co., Inc., 1826 E. Somerset St., Philadelphia 34, jacket, flying man's, intermediate, sage green, 2,500 ea., coveralls, flying man's, sage green, 1,100 ea., (IFB 33-602-55-191B), $39,825.

Eastman Atlantic Mfg. Co., E. 16th & N. Claymont Sts., P. O. Box 25, Wilmington 99, Del., parts applicable to E2 and E3 oxygen servicing trailer; hose assy, high pressure, 4,760 ea., 1,666 ea., 3,281 ea., (IFB 33-602-55-137B), $51,723.

Columbus Jack Corp., 2200 S. Third St., Columbus 7, Ohio, parts applicable E2 and E3 oxygen servicing trailer; adapter-purifier elbow, 826 ea., fitting-outlet low pressure, 578 ea., trough-cyl. dup. lwr. outside, 7,335 ea., (IFB 33-602-55-137B), $60,077.

Belleville Shoe Mfg. Co., Main and Walnut Sts., Belleville, Ill., shoe, flight deck, man's, ankle high, leather, (IFB 33-602-55-183B), $31,781.

Southern Athletic Co., Inc., 111 17th St., Knoxville, Tenn., jacket, aircrew man's, single breasted, 25,000 ea., (IFB 33-602-55-170B), $700,000.

HEADQUARTERS, AIR MATERIEL COMMAND, Dayton, Ohio.

Utica Div., Bendix Aviation Corp., Utica, N. Y., starter assy., 200 ea., (IFB MIPR R-55-6183-TCAFS-03C), $56,018.

Red Bank Div., Bendix Aviation Corp., Eatontown, N. J., generators, regulators, voltage control panels., (IFB PR PE-235861), $1,480,442.

Kaiser Aluminum and Chemical Corp., Oakland, Calif., facilities for the production of extrusions, (IFB PR 148950), $738,350.

Wright-Aeronautical Div., Curtis-Wright Corp., Wood-Ridge, N. J., maintenance and overhaul tools, bulk, (IFB MIPR R53-3427-14-AER, Amendment 14), $800,000.

Phillips Petroleum Co., Bartlesville, Okla., facilities, (IFB PR 148871), $27,800.

Jack and Heintz, Inc., Cleveland 1, generators, 224 ea., spare parts, 184 ea., (IFB PR PE-208389), $154,169.

Sperry Gyroscope Co., Great Neck, Long Island, N. Y., QF-80 drone systems, 6 ea., (IFB PR 45756), $160,264.

Farnham Manufacturing Div., Weisner-Rapp Co., Inc., 1600 Seneca St., Buffalo 10, N. Y., milling machine, airframe, type A, 17 ea., milling machine, airframe, type C, 4 ea., milling machine, airframe, type E,

the LANDING GEAR SWITCH

ELECTRO SNAP

Hermetically-Sealed LIMIT SWITCHES

Only Electro-Snap Hermetically-Sealed Limit Switches have ALL parts (terminals, switch and operating mechanism) sealed in a dry, inert gas. This complete sealing insures dependable operation anywhere—at any altitude, temperature or humidity. That's why we can say "this switch is environment-free." That's also why Electro-Snap Hermetically-Sealed Switches are first choice of leading aircraft manufacturers for landing gear control and other aircraft switching.

Two Electro-Snap Hermetically-Sealed Limit Switches provide positive, dependable control on typical landing gear application.

ELECTRO SNAP

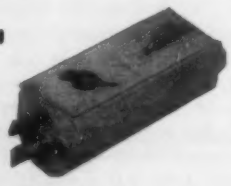
Hermetically-Sealed Switches

Used On:

T-37, RB-66, B-66, B-58, TF-102, F8U, F7U, F3H1, F3H2, F3H3, F-101, B-36, Regulus, F-102, C-122, F-104, C-130, Seadart, and many other experimental and production aircraft.

ROCKET safety SWITCH

—Another Hermetically-Sealed Switch by Electro-Snap. Now used on today's newest fighter aircraft for indicator and sequence circuits in rocket tubes.



Write for full details in Data Sheet HM-9.

ELECTRO SNAP

ELECTRO-SNAP
SWITCH AND MFG. CO.
4234 West Lake Street, Chicago 24, Illinois

9 ea., (IFB PR 205080), $6,083,385.

Onsrud Machine Works, Inc., 3900—32 Palmer St., Chicago 47, milling machine, airframe, 18 ea., packaging, 18 ea., chip collection, 18 ea., (PR 205080), $4,695,966.

Kollsman Instrument Corp., 80-08 45th Ave., Elmhurst, N. Y., Machmeter, type A-2B, 297 ea., (IFB PR 203356), $66,467.

Royal Jet, Inc., 1024 Westminister Ave., Alhambra, Calif., tank assys., 1,218 ea., (IFB PR 154530), $1,448,014.

Airborne Accessories Corp., 1444 Chestnut Ave., Hillside 5, N. J., actuator, electro mechanical, 66 ea., actuator assy., aileron trim tab., 72 ea., actuator assy., aileron tab, 10 ea., (IFB PR SA-546165, SA-546166 and SA-546167), $36,485.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., transmitter, rate of flow, fuel, 818 ea., (IFB PR 203244), $232,174.

Charles Beseler Co., 219 South 18th St., East Orange, N. J., projector, opaque object, 240 ea., (IFB MIPR R55-0036-USMC-ENG), $47,700.

RKO-Pathe, 1270 Ave. of America, New York, N. Y., write script, furnish storyboard, and production motion picture for project 19167, (IFB RFP 33-600-55-5294 and PR 236062), one, $40,961.

Sam Orleans and Associates, Inc., 211 West Cumberland, Knoxville, Tenn., production of motion picture, project TF 1-8152, (IFB RFP 33-600-55-5290 and PR 178772), $25,687.

Cineffects, Inc., 115 W. 45th St., New York, N. Y., write script, furnish storyboard, production of motion picture for project SFP 366, (IFB PR 178766 and RFP 33-600-55-5282), $45,001.

Northrop Aircraft, Inc., Hawthorne, Calif., construction of a new water line, job, (IFB PR 148983), $30,000.

Fletcher Aviation Corp., Airport, Rosemead, Calif., jettisonable fuel tanks, 1,700 gal., 5,551 ea., (IFB PR 184498 and 154565), $13,127,464.

Aluminum Company of America, Pittsburgh, Pa., facilities for the production of aluminum plate, (IFB PR 194096), $5,700,000.

Boeing Airplane Co., Seattle, facilities, (IFB PR 148853), $8,500,000.

Convair Div. General Dynamics Corp., San Diego, Calif., spare parts, (IFB PR 144023), $510,876.

Reflectone Corp., Post Road, Stamford, Conn., trainer, N/3 dead reckoning, 5 ea., spare parts, lot, (IFB PR PA-225760), $1,551,771.

Allison Division-Aeroproducts Operations General Motors Corp., Dayton, prop assys., installation, 72 ea., prop assys., training, 4 ea., (IFB MIPR R55-2836-137Aer), $1,965,080.

Crosley Div., Avco Mfg. Corp., 2630 Glendale-Milford Road, Cincinnati 15, Ohio, replenishment spare parts, (IFB PR 401981), $687,963.

Fairchild Camera and Instrument Corp., Robbins Lane, Syosset, Long Island, N. Y., kit, modification, 9,563 ea., (IFB PR 599967 and 599967-1), $141,991.

Wac Engineering Co., 35 South St., Clair St., Dayton, print chopper, 88 ea., (IFB PR 600012), $44,500.

Lear, Inc., 110 Ionia Ave., N.W., Grand Rapids, Mich., prototype autopilot, 3 ea., autopilot, type MC-1, 31 ea., (IFB PR PE-177990), $1,195,318.

Hoover Electric Co., 2100 S. Stoner Ave., Los Angeles, Calif., motor, hydraulic pump, 221 ea., (IFB PR SA-546169), $40,885.

SACRAMENTO AIR MATERIEL AREA, Calif.

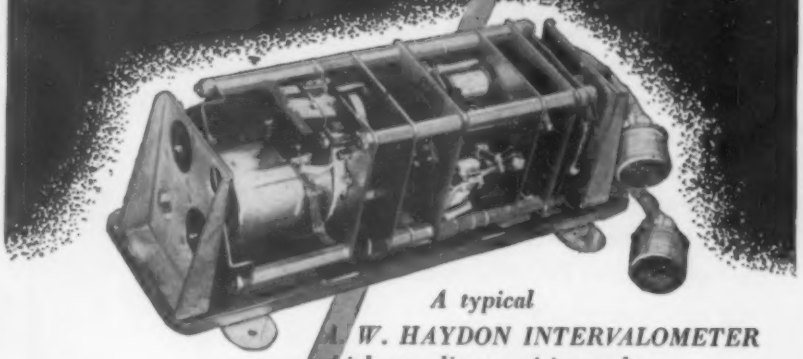
Frederick J. Chapek, 605 Fremont Way, Sacramento, Calif., installation of cooling towers, (IFB 181), job, $28,973.

California Crating Corp., 12604 Chadrow Ave., Hawthorne, Calif., recrating of external jettisonable fuel tanks, job, $636-266.

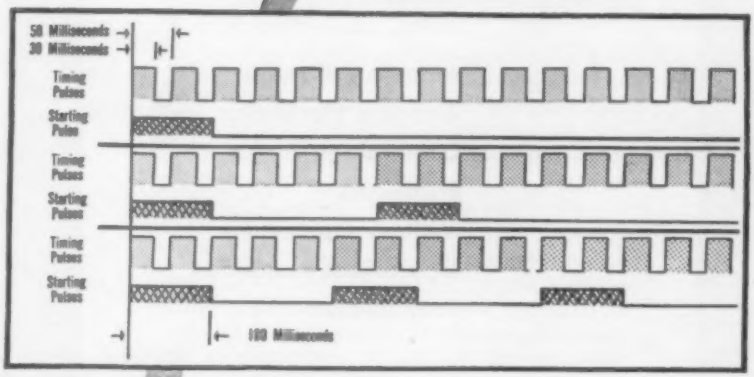
Solar Aircraft Co., 2200 Pacific Highway,

Short Interval Timing Your Problem?

A. W. HAYDON CAN HELP YOU.



A typical
A. W. HAYDON INTERVALOMETER
which supplies precision pulses
as shown on Chart below.



THREE TYPES OF OPERATION

The operator adjusts a selector switch to determine the type of operation.

OPTION #1. When a starting pulse of 100 Milliseconds is applied, this Intervalometer starts up and energizes 15 Pulsing Circuits at 50 Millisecond intervals. Each circuit is on for 30 Milliseconds. At the end of the period, the unit automatically resets to the starting position.

OPTION #2. When a starting Pulse of 100 Milliseconds is applied, this Intervalometer starts up and energizes 6 Pulsing Circuits, then shuts down. When the next starting pulse is applied, the balance of 9 pulsing Circuits are energized. The unit then resets to the starting position.

OPTION #3. When 1st starting Pulse is applied 5 Pulsing Circuits are energized. When 2nd starting Pulse is applied next 5 circuits are energized. When 3rd starting Pulse is applied next 5 circuits are energized.

Write for General CATALOG or Submit Detailed Problem Statement.

The A. W. HAYDON Company
222 NORTH ELM STREET, WATERBURY 20, CONNECTICUT
Design and Manufacture of Electro-Mechanical Timing Devices

OPERATIONS ENGINEERS

Concurrent with the establishment of a Military Relations Department at the Fairchild Aircraft Division, an Operations Engineering organization has been established. The purpose of this new group is to provide technical information for use by Fairchild Military Relations representatives, as well as by personnel in Fairchild's engineering departments. This new group will conduct studies on specific Fairchild airplanes, as well as systems studies relating to possible future Fairchild developments.

The scope of this organization is such that additional engineers are required in the following fields:

Aircraft Utilization
Airborne Electronics
Climatology
Economics
Military Operations
Operations Research
Propulsion

The opportunities and salaries associated with the new positions are in keeping with the responsibilities of this work. Employee benefits in the form of group insurance, individual and family coverage for hospitalization, retirement plan, sick leave, etc., are also provided.

Send complete resume of education and experience, together with salary requirements to:
EMPLOYMENT MANAGER

ENGINE AND AIRPLANE CORPORATION
FAIRCHILD
Aircraft Division

805 PENNSYLVANIA AVENUE

HAGERSTOWN, MD.

ALL REPLIES WILL BE HELD IN STRICT CONFIDENCE.

San Diego, Calif., gas turbine tailpipe, adapter, 665 ea., $40,598.

Segar Refrigerator Co., 850 Arcade St., San Diego, Calif., brace, mechanism assy. & fin assy., 920 ea., $41,593.

Republic Aviation Corp., Farmingdale, L. I., N. Y., brace sway, valve assy., fin assy., 3,830 ea., $109,926.

North American Aviation, Inc., Los Angeles Intl. Airport, Los Angeles, Calif., accomplishment of T.O. on IF-86-511 on F-86F aircraft, 134 ea., $97,502.

DAYTON AIR FORCE DEPOT, Ohio.

Boeing Airplane Co., Wichita Div., 3801 S. Oliver, Wichita, Kan., miscellaneous cable assemblies, (IFB RFP 33-604-55-3333), 20 items, $60,918.

Bogue Elec. Mfg. Co., 52 Iowa Ave., Paterson 3, N. J., copy suitable for photolithographic reproduction for handbook of operation and service instructions USAF Spec MIL-H-7960A covering nacelle testers and calibrators, copy suitable for photolithographic reproduction for illustrated parts breakdown USAF Sec. MIL-B-5005A covering nacelle testers and calibrators, reproducible copy for handbook of instructions and parts breakdown, spec. MIL-H-7298 covering single-phase generator, (IFB RFP 33-604-55-2925), $54,238.

Fenwal Inc., Pleasant St., Ashland, Mass., miscellaneous switches, thermostatic control, (IFB RFP 33-604-55-1945), 4 items, $56,882.

General Electric Co., Schenectady, N. Y., tube, electron, receiving, power output, pentode, type 6005/6AQ5W/6095, 40,000 ea., tube, electron, receiving, triode, general purpose, JAN type 5670WA, 17,000 ea., (IFB RFP 33-604-55-3197), $142,090.

General Electric Co., Radar & Precipitation Transformer Plant, Holyoke, Mass., transformer-assy., oil-immersed hermetically sealed modulator blocks, 15 ea., (IFB RFP 33-604-55-3442) $25,748.

General Electric Co., Hudson Falls, N. Y., miscellaneous capacitors, 13 items, (IFB RFP 33-604-55-3657), $26,288.

Herbach and Redeman, Inc., 1204 Arch St., Philadelphia 7, Pa., miscellaneous toggle switches, (IFB-33-604-55-114), 22 items, $47,442.

J-B-T Instrument, Inc., 441 Chapel St., New Haven 8, Conn., miscellaneous toggle switches, (IFB 33-604-55-114), 5 items, $33,076.

Leach Relay Co., 5915 Avalon Blvd., Los Angeles 3, Calif., miscellaneous relay, armature, 5 items miscellaneous relays, solenoid, 3 items, (IFB RFP 33-604-55-3709), $29,397.

M. B. Mfg. Co., Inc., 1060 State St., New Haven 11, Conn., calibrator, motional pickup, MA-1, 200 ea., (IFB RFP 33-604-55-2869), $180,850.

Polarad Electronics Corp., 43-20 Thirty-Fourth St., Long Island City 1, N. Y., spectrum analyzer set AN/UPM117, 136 ea., (IFB RFP 33-604-55-2513), $412,453.

Raytheon Mfg. Co. Microwave and Power Tube Operation, Waltham 54, Mass., tube, electron, transmitting, magnetron, USAF type 2J51A, 750 ea., (IFB RFP 33-604-55-3107), $213,750.

James S. Spivey, Inc., 4908 Hampden Lane, Washington 14, D. C., calibrator, freq., crystal controlled, two output frequencies 50 kc. and 1,000 cps, fixed, 880 ea., (IFB RFP 33-604-55-3464), $36,300.

Tung-Sol, Inc., 95 Eighth Ave., Newark, N. J., tubes, electron, type 6AU6WA, (IFB PR GE-573126), 43,000 ea., $39,560.

Aeromotive Equipment Corp., 1632-8 Central St., Kansas City 8, Mo., echo box TS-488A/UP, 61 ea., (IFB MIPR'S: NORD 320-55, R-55-884B-54136 BuShips), $29,997.

Genisco Inc., 2288 Federal Ave., Los Angeles 64, Calif., stand assembly, accelerometer test, 12 ea., (IFB RFP 33-604-55-2943), $77,895.

Sprague Electric Co., Marshall St., North Adams, Mass., misc. capacitors-fixed, paper, 16 items misc. suppressors-elec., noise, 3 items, (IFB RFP 33-604-55-3005), $25,664.

Hoffman Labs., Inc., 3761 S. Hill St., Los Angeles 7, Calif., simulators-beacon, 178 ea., (IFB RFP 36-04-055-3419), $1,042,134.

United Can Co., c/o R. M. Reutlinger & Associates, Inc., 1512 Hulman Bldg., Dayton, Ohio, misc. fiber containers with metal ends for parcel post packages, 4 items, (IFB PR: 43-55-LP-1512), $29,948.

Bendix

International in Aviation

The part of Bendix in the technical progress of aviation is vast and varied. Because Bendix has always anticipated aviation's next advance, every plane that flies, in some way, relies on Bendix Creative Engineering.

Bendix weather instruments provide the vital data for flight plans. Bendix filters guard the fuel used by engines equipped with Bendix starters, generators, ignition and fuel systems. Bendix automatic pilots, instruments, radio, actuating mechanisms, and other scientific devices surround planes with safety and guide them to port.

Bendix is first in fuel metering systems for jets, ram jets and turbo-prop engines—a leader in landing gear—the world's largest producer of Aviation Instruments and Accessories—the standard of major airlines in radio and other electronic equipment.

When you see the name "Bendix Aviation Corporation" on any product, you can buy that product with complete assurance that it is the final word in creative engineering and the last word in quality.

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Bendix International

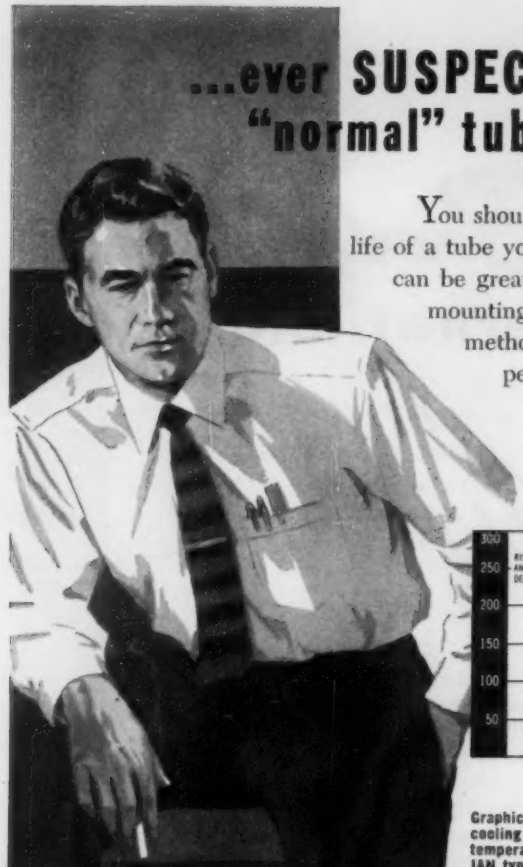
THE NAME Bendix AVIATION CORPORATION ASSURES QUALITY

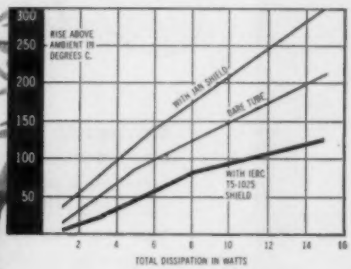
TRADE NAMES OF AMERICA'S FOREMOST FAMILY OF AVIATION PRODUCTS

Bendix · Eclipse · Pioneer · Skinner
Stromberg · Friez · Pacific

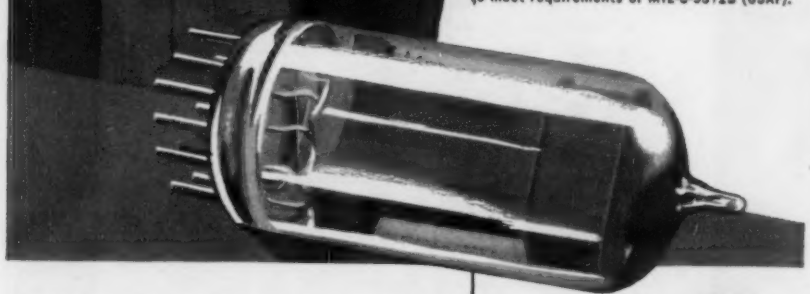
...ever SUSPECT those "normal" tube failures?

You should... because the service life of a tube you now accept as normal can be greatly extended with IERC mounting techniques. With other methods, high operating temperatures deteriorate the tube... causing those premature, so-called "normal" failures!



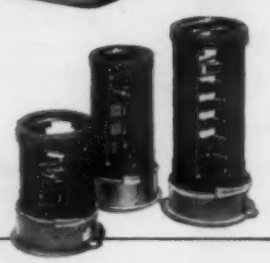


Graphic evidence of IERC's effective tube cooling is shown in comparison with harmful temperature increases that occur with use of JAN type shields. IERC shields are designed to meet requirements of MIL-S-9372B (USAF).



HEAT-REDUCING, VIBRATION-PROOF PERFORMANCE

IERC's complete line of miniature tube shields have proved so efficient in reducing bulb temperatures and prolonging tube life that they have become the first choice of almost every leading manufacturer of aircraft radio, missiles, radar, computers and other types of precision electronic equipment!



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AMC Announces Staff Changes

Dayton—Air Materiel Command has reassigned three staff officers and eight operational officers in the Directorate of Procurement and Production.

The staff reassignments are:

• **Col. Richard B. Uhle** is Assistant Deputy Director of Procurement, succeeding Col. Lee W. Fulton, recently transferred to Baltimore. Col. Francis Henggeler succeeds Col. Uhle as chief of the Programs and Analysis Office.

• **Col. John B. Dick** is Assistant Deputy Director of Production, the position formerly held by Col. Louis H. Garrett, who is transferring to Middletown (Pa.) Air Materiel Area as Assistant Deputy Director of Production.

• **Col. Ralph H. Schaller** has been named Deputy Director of Mobilization, succeeding Col. Joe Daniel.

The eight operational reassignments include:

• **Col. Francis J. Corr**, new chief of the Support Division, came from Headquarters, USAF, where he was Deputy Assistant for Mutual Security.

• **Col. Philip Kuhl**, technical assistant for production engineering in the Industrial Resources Division, comes from Headquarters, USAF, where he was chief of the Industrial Equipment Branch.

• **Lt. Col. Desider A. Simcoe, Jr.**, new chief of the Industry Support Section in the Industrial Resources Division, has been assigned to AMC since 1951. He succeeds Col. William J. Adams, who has transferred to the Philadelphia Air Procurement District.

• **Lt. Col. Wallace S. Martin**, chief of the Weapon Systems Staff Division, a new division that will act as the worldwide AMC focal point for the Air Force and industry in matters pertaining to weapon systems management. Col. Martin has been with AMC since September 1953.

• **Col. Manford J. Wetzel**, chief of the Bombardment Branch in the Aircraft Division, comes to AMC from the National War College, succeeds Col. Martin.

• **Col. Leonard E. Symorski**, chief of the Nuclear Bomber Branch of the Aircraft Division, formerly was a student at the Naval Air College. He replaces Col. R. J. Iverson.

• **Col. Henry M. Harlow**, chief of the Missiles Branch of the Aircraft Division, came to AMC after spending two years on Okinawa.

• **Col. Isaac M. Larkey**, executive of the Aircraft Division. He has been at AMC since March 1951.

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Aviation Week Buyers' Guide, Nov. 28

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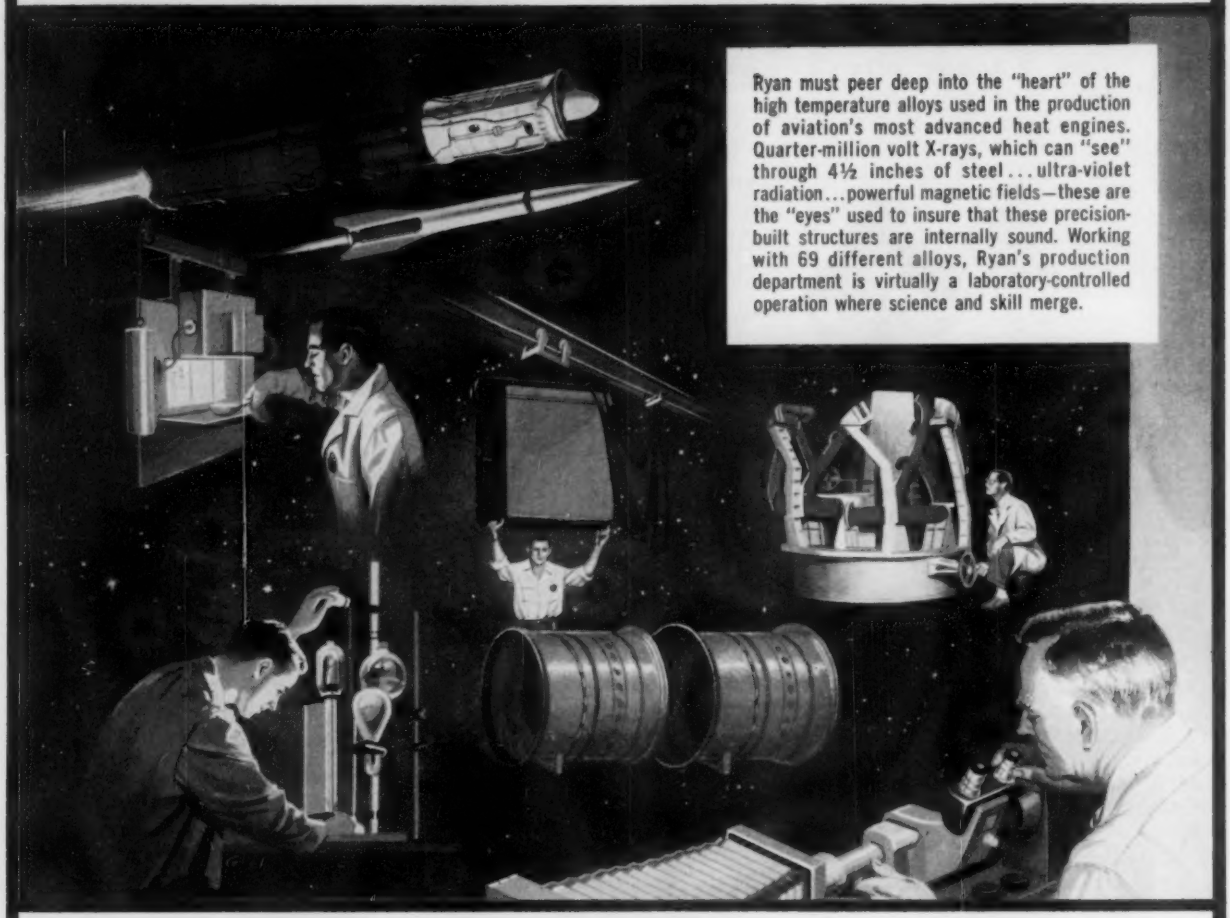

Ryan must peer deep into the "heart" of the high temperature alloys used in the production of aviation's most advanced heat engines. Quarter-million volt X-rays, which can "see" through 4½ inches of steel... ultra-violet radiation... powerful magnetic fields—these are the "eyes" used to insure that these precision-built structures are internally sound. Working with 69 different alloys, Ryan's production department is virtually a laboratory-controlled operation where science and skill merge.

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CAL Works to Adjust Man to Supersonic

Subsonic man has been thrust into the supersonic era, and he cannot survive alone. In an age where the evolution of the machine has outstripped his own, man has become dependent upon a new realm of research and development, a study-type that has come to be known as human factors engineering.

As the name implies, it is a research process designed to make man compatible with the machine. And it has been up to the military to take over the leadership in the field, to provide the funds, the paper work, the programs and, finally, the "guinea pigs" to test the evolved equipment under actual conditions.

Many of the answers needed to keep man alive in his new age have been provided by universities and private research laboratories working under military sponsorship. Typical of such work is the research being carried on at the Cornell Aeronautical Laboratory, Inc., of Buffalo, N. Y., a fairly new device in its own right. A summary of the laboratory's work, prepared for Aviation Week by a CAL staff member, follows:

The studies at Cornell Aeronautical Laboratory, Inc., can be divided into three basic groups: function (of the pilot), comfort and safety. They have included head impact investigation, automatic parachute releases, supersonic cockpit studies, development of padding materials, evaluation of human movements (kinetics) in crashes and aircraft tire testing.

Basic to human engineering development is the provision of aircraft "crashworthiness." Obviously, studies of human factors in flight should begin with means of saving life and preventing injury.

Research has shown that three out of four crash fatalities result from head injuries. Head impact studies at Cornell Aeronautical Laboratory for the Medical Sciences Division of the Office of Naval Research gave three definite conclusions:

- **The head will be critically injured** in a crash against a flat, rigid surface at an average impact energy of about 600 in./lb. (60 inches multiplied by ten pounds).
- **If low density,** energy-absorbing materials are used as padding materials on the crash surfaces, the head can take impacts five times greater than if crash surfaces are not so padded.
- **Surfaces which the head may strike** in a crash should have four characteristics: they should be flat or with large radius of curvature, rigid enough to help support the head but deflect under contact, smooth with no sharp edges, deformed so as to provide as large a contact surface as possible.

To prevent pilots from losing consciousness in a crash, CAL studied existing helmets and offered a new design. The beam-pad helmet which acts as a beam to distribute the force of a blow over a wide area of the wearer's head and acts as a soft cushion for comfort.

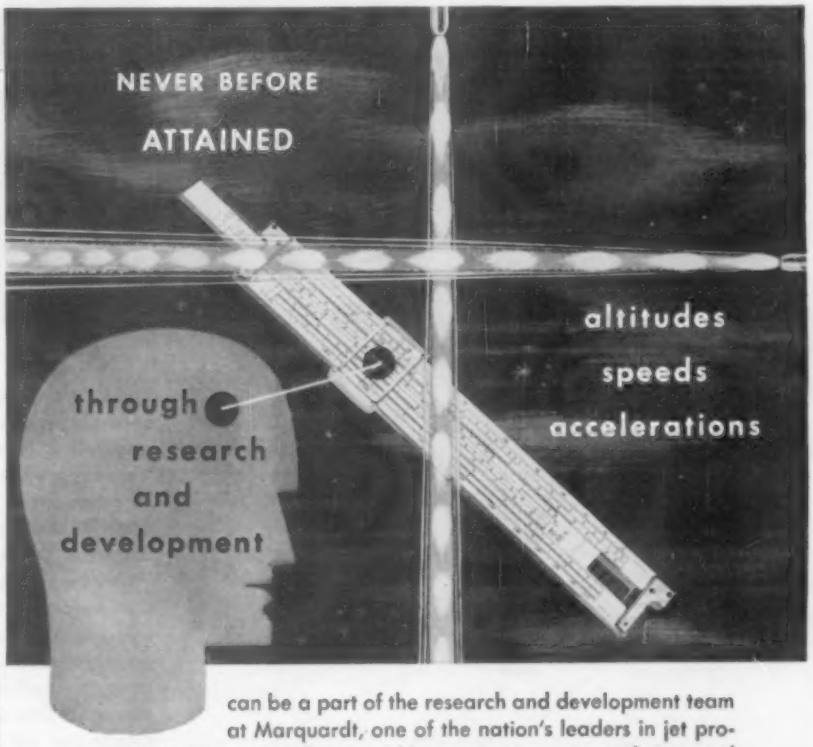
A unique feature was a geodetic suspension system. This consists of a strap arrangement to cradle the helmet on the head so that, regardless of the angle of a blow, the helmet does not "bottom" against the head in a crash.

Accident prevention and lessening of effects when accidents do occur was another phase of safety research. CAL engineers used test equipment consisting of a typical, light weight auto and dummies dynamically similar to human counterparts.

A marked similarity between the effects of auto and plane crashes had previously been noted. In most cases, findings here are applicable to aviation.

Accident Movements

Tests showed that movement of vehicle occupants in the front seat during crashes are predictable. First,



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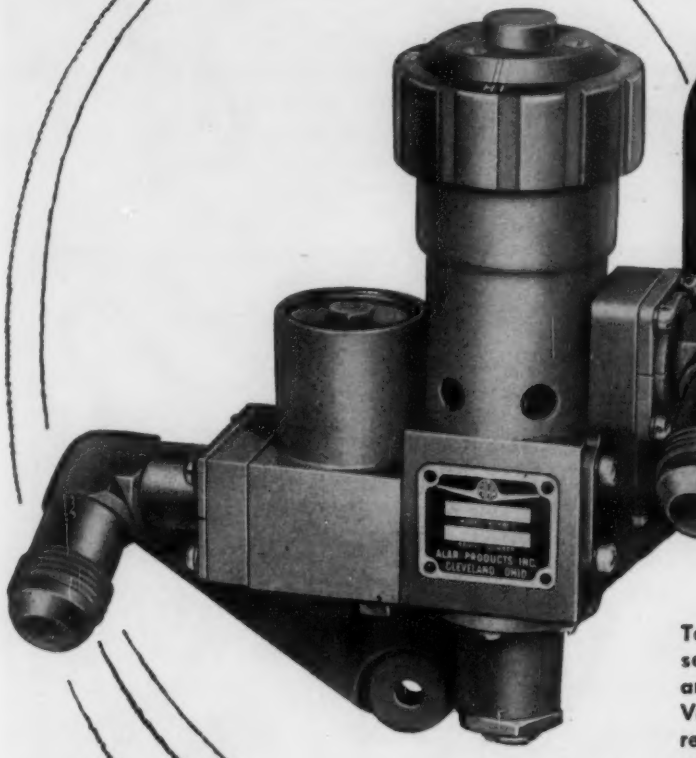
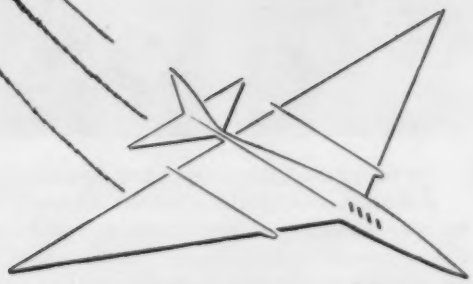


think FOR THE **pilot**



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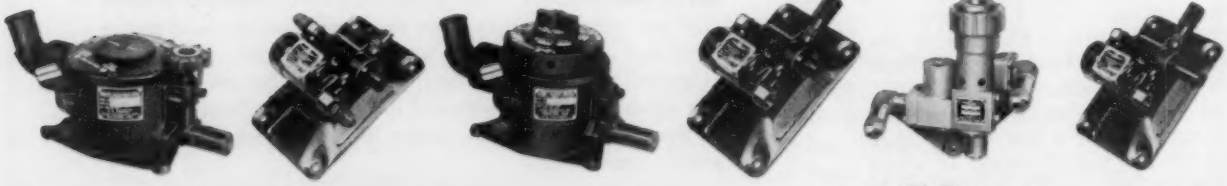

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torso rotation about the hip joint is followed by an acceleration of the body upward and forward at about a 45° angle to the vehicle.

After the body strikes the vehicle interior, the next movement depends on specific test conditions. The driver consistently suffers a chest blow against the steering wheel and a head blow against the upper windshield or adjacent moulding.

Knowledge of these motion characteristics in crashes has been a great aid to engineers in developing safety devices. However, safety in aviation is a complex of many factors. Because takeoffs and landings, for instance, can be dangerous maneuvers, mechanical pilot aids, such as the instrument landing system (ILS) are expedient.

CAL, under an internal research grant, developed a system known as binaural guidance to be used in conjunction with ILS. This system frees the pilot's visual attention from his array of instruments by giving him some auditory signals through earphones. It can guide him through vertical and lateral flight, in take-offs and approaches when the visual strain is greatest.

Binaural guidance conforms with usual radio-range guidance systems in this respect the pilot flies away from the code to reach the beam center. For instance, in binaural lateral guidance, he turns right when the signal is prominent in his left ear.

Use of binaural system also was suggested in a study of blind landing systems which the laboratory performed. In evaluating needs for an automatic carrier landing system, the usual talk-down procedure—coupled with a simple system of frequent binaural systems—was suggested as a means for the aircraft to approach the carrier safely.

Automatic carrier landing systems used at airports cannot be entirely applied to aircraft carriers since the carrier's available landing area is small and unstable. This investigation outlined some problems that have to be considered in development of automatic carrier landing systems: Traffic patterns, radar equipment, antenna stabilization, computers, safety devices and the guidance data technique just mentioned.

Lessening the effects of acceleration on the pilot is one of the greatest problems human engineers must solve. In 1946, one of the laboratory's pioneer efforts for the Aero-Medical Laboratory, Wright Field, was the development of equipment which would produce extreme forces on the human body and enable engineers to study the physiological reactions of the pilot. Known as a decelerator, it was a controlled means of simulating crash landings or violent maneuvers.

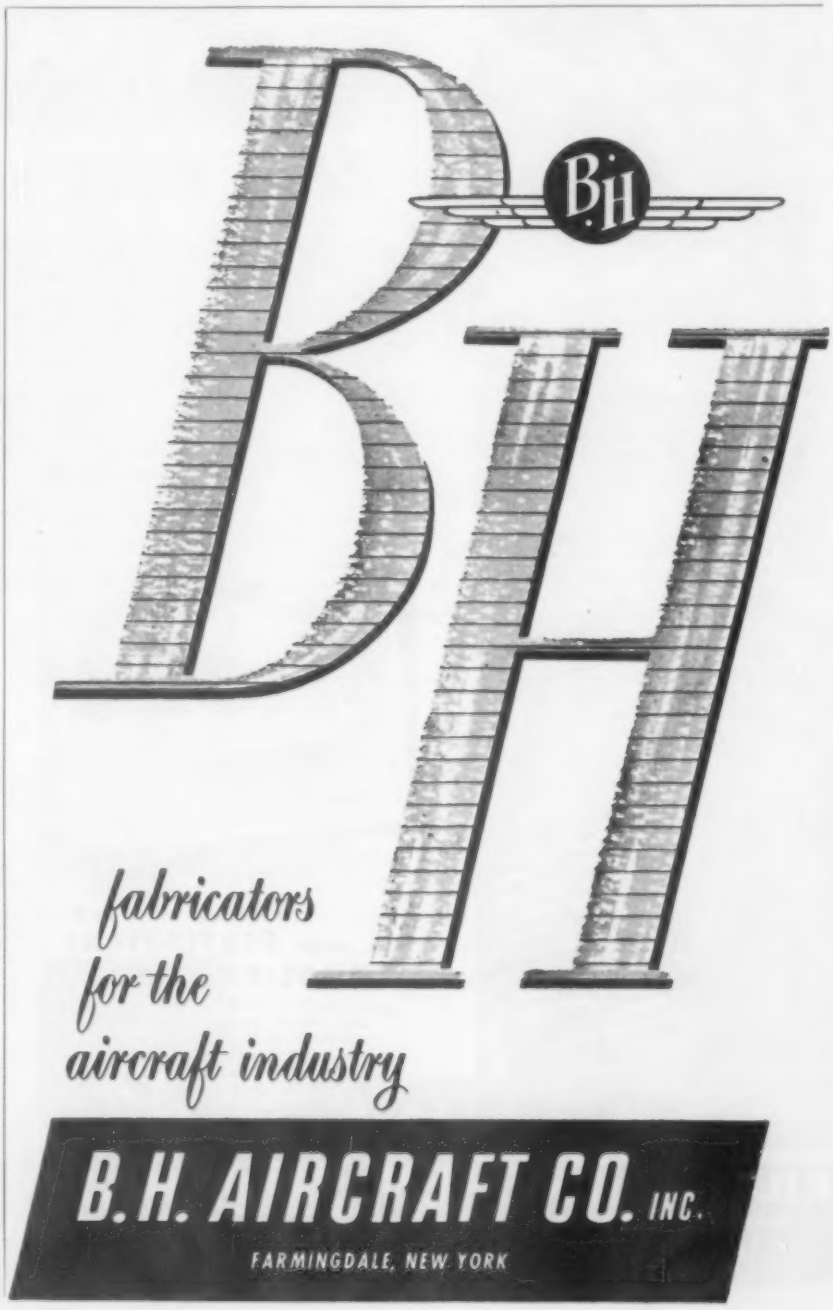
Comparative physiological studies were possible with this equipment. Even facial reactions were recorded by a high speed camera mounted inside the test car.

Three years later, experimental pilot equipment to produce angular acceleration was developed. The equipment was chiefly concerned with a cockpit of moderate size whose rotation about a fixed axis was to be carefully controlled.

Supersonic Cockpit Study

Another study of significance in the human engineering field was the supersonic cockpit study. The Special Devices Center, Office of Naval Research, contracted with CAL early in 1947 to look into human factors in supersonic cockpit configuration. The result was a monumental joint effort of the Aero-Mechanics and Engineering Physics Departments at CAL and the Cornell University Medical College in New York City. The project report, written as a guidebook for aircraft designers, is a compilation of articles and reports and evaluation of the physical and psychological reaction to supersonic flight.

This project has since been revised and expanded to include research data



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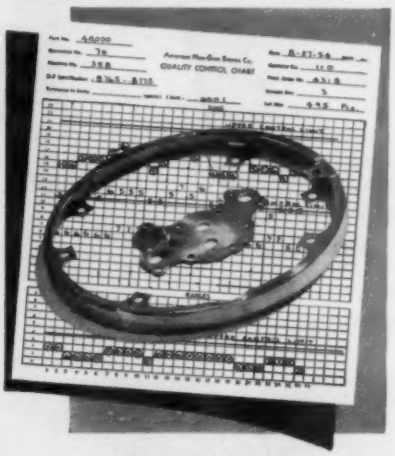
obtained from current supersonic research aircraft. This manual is used today in research departments of most aircraft and aircraft equipment manufacturers.

Some years ago aircraft designs were considered adequate if the pilot returned safely. Criteria changed as very high or low temperatures, poor vision, noise harrassment, hypoxiz (lack of oxygen) hindered pilot efficiency at high speed and altitudes. Mounting pilot complaints finally gave rise to complete recognition of human factors involved in flight.

CAL's supersonic cockpit report covers temperature environment, controllability of the plane, emergency escape, effects of acceleration, noise, equipment arrangement, vision, pressure, cosmic rays, ozone.

Crouching or straining, two strategems employed to prevent effects of acceleration, are now believed to cause ruptured disc or early fatigue. Prone or supine position in VTOL aircraft may cause brain damage from shocks if power failure or cabin jettisoning occurs.

An automatic, rotable anti-G seat, controlled by an electro-hydraulic mechanism, was recommended as a possible answer to the acceleration problem in the report for the Office of Naval Research.



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Arranging equipment in a supersonic cockpit is an outgrowth of the acceleration problem. In supersonic flight, the pilot must assimilate and integrate data from instruments faster than ever because greater distances are covered in a shorter time. However, he may be in an inconvenient position.

If he is in a prone or supine position to take the stress of high speeds, his cabin work area may have to be rearranged. Because of repositioning, instruments should take up the least possible space and still be readable. The number of instruments should be minimized, but superimposing several indicators on one dial only makes the pilot's job more difficult.

Also more work on cabin areas is needed, and the rotatable seat design, previously mentioned as a means of helping the pilot stand the effects of speed, must be given more detailed study.

The Pilot and Temperature

Another pilot consideration, temperature environment, was studied in two phases: heat and cold level tolerance and the pilot's psychological and physiological temperature tolerance.

The pilot handles his ship inefficiently at a certain level of heat and cold, even though physically he may be able to stand that level. So, consideration had to be given to both the physiological and psychological temperature barriers.

As flight speeds increase, temperatures rise in the boundary layer (air near the plane's surface). Heat flows to the cabin wall and then is transmitted to the cabin from which is must be removed or else cooled.

An intrawall cooling system to circulate cooled air through the cabin, into the space between two layers of insulation in the wall and then discharging it to the outside, is discussed in the report.

Emergency escape is another complex problem at supersonic speeds. Parachute and ejection seat escape may cause a severe opening jolt, lack of oxygen, bends or frostbite during descent.

The extreme air velocity which hits the escaping pilot may cause him to lose consciousness. The opening jolt in a parachute is three and one-half times greater at 40,000 feet than at 10,000 feet. If a man does survive this initial shock, he may either freeze during the descent or run out of oxygen.

These emergency escape problems were considered in an evaluation of a jettisonable capsule, such as the cabin itself. As long as the cabin wall of the jettisonable capsule is not ruptured, the cabin air will have adequate oxygen,

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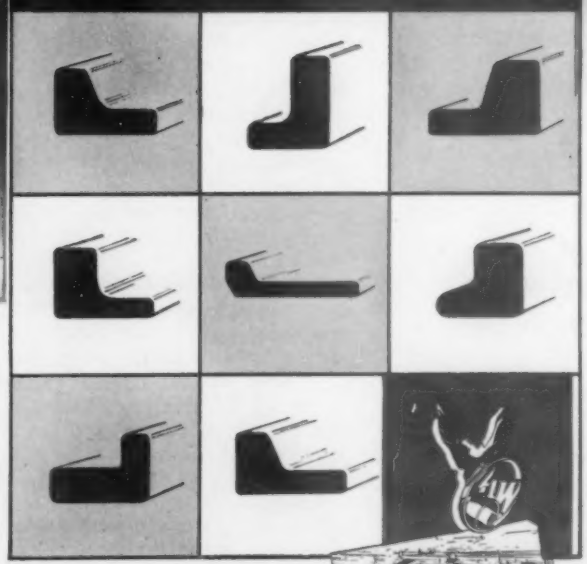

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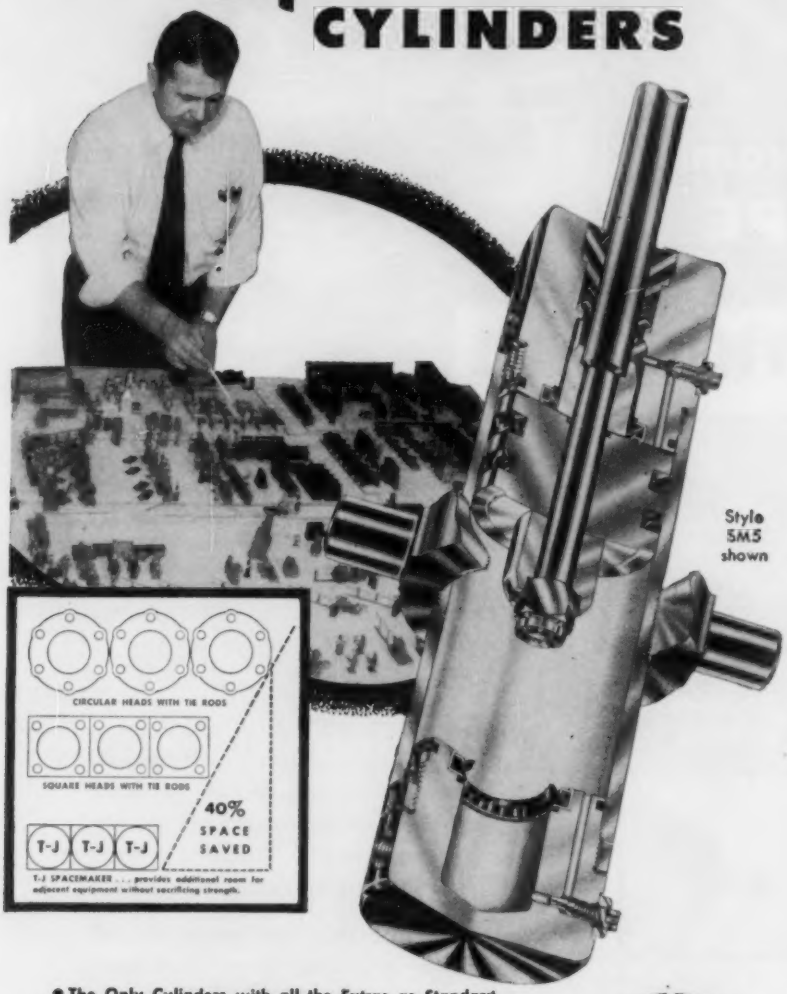
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and the cabin itself will prevent excessive and dangerous variations in temperature during the fall.

Limitations of the capsule also are discussed: difficulty in clearing the aircraft on separation, stabilizing the cabin during descent, decelerating the cabin before pilot escape or landing.

Air Pressure

Air pressure poses a particular problem in supersonic flight. Pressure decreases with increase in altitude. Man needs sufficient pressure to permit oxygen absorption through lung capillaries into the blood stream. Therefore, some kind of pressurized cabin to increase pressure must be used in supersonic or high-altitude flight.

However, a completely pressurized cabin presents the possibility of explosive decompression and a ruptured cabin wall. Since rapid descent to prevent loss of oxygen is precluded by high altitude requirements of supersonic planes and self-sealing walls and auxiliary air equipment are impractical, it was concluded that partially pressurized cabins, partial pressure suits and pressure breathing equipment provide the best emergency measures.

Many CAL studies have followed through on the supersonic cockpit project.

Controllability, a significant part of the project, today is recognized as a major laboratory work.

Aircraft Controls

The first airplane controls were rudder pedals and a stick. Today, controls are highly complex. The laboratory has devised a means of linking servo systems to control systems to ease the pilot's burden.

The pilot maintains complete command of the plane through conventional cockpit controls but, by means of highly specialized equipment, control surfaces move independently and thereby introduce stability into the airplane.

A further development, a knob-control system, superimposed on this equipment, adjusts the stick force and motion to the amount the pilot wants for proper control "feel." A simple change of knob settings will vary the "design" of the plane in flight, and the effect of the "design changes" on stability and control of an aircraft can be evaluated.

Numerous military pilots have test flown the variable stability aircraft to evaluate the various settings and the aircraft's consequent behavior. Ultimately, research such as this will enable designers to build airplanes with the optimum in handling characteristics and "feel" for the pilot of the future.

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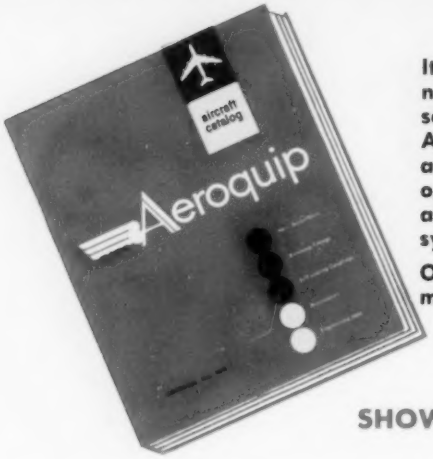

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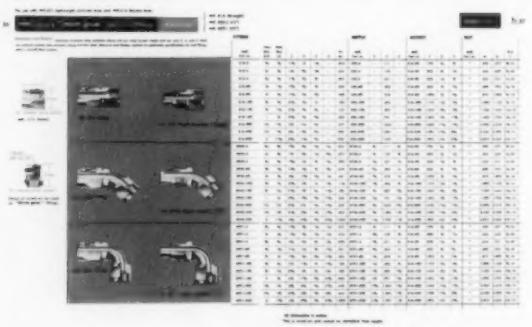
SHOWN HERE ARE REPRODUCTIONS OF TYPICAL PAGES

in section a

There are 34 pages packed with information about Aeroquip AN-MS and new lightweight hose assemblies for all pressure ranges and aircraft fluid systems, complete part number information on Aeroquip elbow hose assemblies, fittings, assembly instructions, and ordering instructions.



in section b

18 pages describe fully Aeroquip hose fittings and components. Included are standard flange and swivel nut types. Also given are tube bend data for elbow assemblies, ordering information, and special fittings data.

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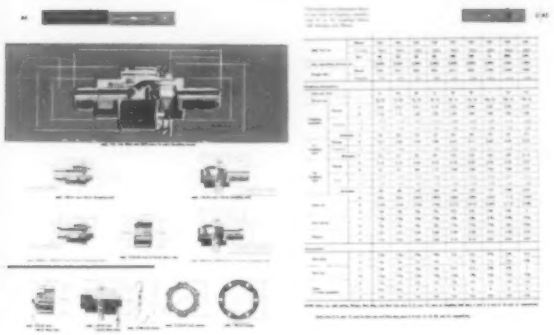
Complete Hose Line and Coupling Information

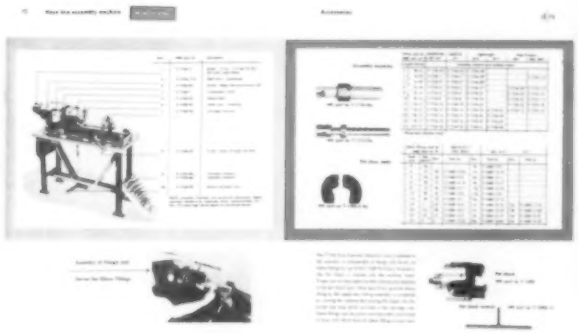
in section c

You'll find information on Aeroquip Self-Sealing Couplings for all commonly used aircraft fluids. Installation instructions are complete and well illustrated. Included are pressure loss characteristics and ordering instructions.



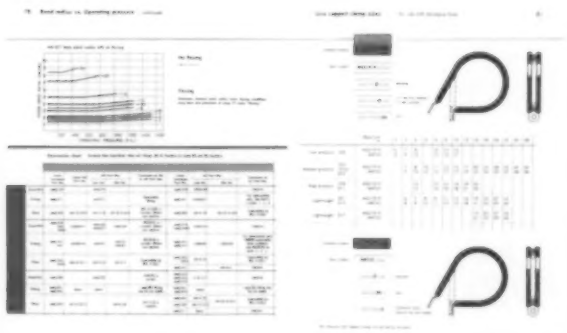
in section d

There is useful information on tools for hand assembly of Aeroquip hose lines, "O" ring proof-test adapters, hose cut-off machine, hose line assembly machine and accessories, and the Aeroquip Hydrauliscope.



in section e

You'll find important engineering data to help you in the selection of hose and planning installations, bend radii vs. operating pressures, conversion charts giving latest MS and MIL numbers, support clamp sizes, and more.



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N.J. Firm Begins New Program For Leasing Twin-Engine Planes

Ayer Lease Plan Inc., of Linden Airport, N. J., recently began a new twin-engine aircraft dry-lease plan designed to fit the requirements of small corporations either unwilling to make heavy capital investments or wanting to obtain practical operating experience before deciding on ownership.

The initial success of the program, Ayer reports, has been such that several additional aircraft will be added to the for-lease roster within the next several weeks.

Basically, the lease provides for 30-days use of a Beech C-18S for $800, including hull insurance. Other charges such as pilot's salary, fuel, maintenance and liability insurance, are borne by the leasee. There also is a charge of four dollars per engine hour which is applied against the engine overhaul at 600 hr.

Another requirement is that the customer perform 100-hr. checks on the airplane. During the term of the lease the customer can fly the airplane any number of hours or base it at any place he chooses without affecting the basic $800 rate.

The customer is permitted to modify the airplane's interior if he desires and to install additional or supplementary equipment which can be removed when the aircraft is returned. In some cases, Ayer may offer to purchase the installed equipment if it enhances the plane's leasing value.

If the leasee takes a plane for one year, a portion of the net rental—gross rental minus hull insurance—is applied to the airplane's market price, which is agreed upon when the contract is signed.

Fred Ayer, president of the leasing firm, told AVIATION WEEK that he undertook the venture after encountering stiff resistance in selling multi-engine equipment to many concerns, particularly those without corporate aircraft experience. Such companies want to feel their way into the operation without making a heavy commitment for something they fear might not work out. A proposal to buy an airplane might also meet stiff opposition from the board of directors or stockholders. However, if an airplane can be leased and operating experience gained, the chances of an eventual sale are increased.

Other opportunities include the leasing of planes to firms with heavy seasonal travel periods and during sales conventions when some companies have to move a large number of personnel from various locations to the meeting site and then back again.

The leasor currently has five planes on its list: two Beech C-8Cs, a Continental-powered D18 which leases for $1,000 a month, a de Havilland Dove at $1,750 a month and a Lockheed PV-1 Ventura for $3,000 a month.

The PV-1 Ventura is being presently offered by Ayer only on the basis of a six-months minimum lease agreement.

Three of the Twin Beeches are currently working; one is in Canada, another in Guatemala and the third with a firm handling cargo charter for a large corporation.

Ayer expects to concentrate on the twin Beech as leasing equipment and develop this operation much as Leeward Aeronautical in Miami has specialized in DC-3s—Leeward reportedly now has more than two dozen DC-3s on lease—but the eventual composition of the Ayer fleet will depend upon customer preferences.

Ayer also admits that the venture, begun in mid-August, is still largely experimental and that he has much to learn about the problems involved—the segments of industry that will prove to be the most effective market, how the customers will handle the planes, the type planes they want most and the best equipment for the job.

Converted Convair L-13A

The eight-passenger Husky Mk. 2 shown above has been converted from a Convair L-13 Army liaison plane by Caribbean Traders for the Societe Acrinne de Transports Guyana-Antilles Airlines. The Husky can be transformed into a cargo handler by removing the rear seats. It is powered by a Lycoming R680-13 300 hp. engine.

Landing gear of the new delta-wing Convair F-102A is almost retracted in this test flight takeoff. The new Air Force interceptor, designed to fly day or night — in any kind of weather, exceeded the speed of sound in level flight its second time in the air.

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Pioneer warehouses over 1000 different shapes of aircraft alloys 2024 and 7075 and all Army-Navy drawing standards and standard open die extrusions. This stock, over 800,000 pounds, is the largest in the aircraft industry.

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Pleasure Flyers Lead In 1954 Accidents

Pleasure flying accounted for the greatest number of non-carrier small-plane accidents in 1954 according to a detailed Civil Aeronautics Administration survey.

Of the 3,010 accidents in this category, pleasure flyers accounted for 1,674–199 of which were fatal and produced a death toll of 364. The analysis does not include agricultural flying accidents which will be dealt with in a later study.

Collisions, mostly on the ground, spins or stalls and ground loops ranked as the top three causes of lightplane accidents last year, according to the CAA. They accounted for 658, 561 and 409 accidents respectively. Spins and stalls ranked highest as the cause of fatalities with 191 deaths or 56.1% of the total.

Most common cause factor resulting in accidents and fatalities proved to be the weather, which took the blame for 897 incidents. According to phase of operation, accidents during landing totaled 1,181; in-flight 793; takeoff 666, and taxiing 197.

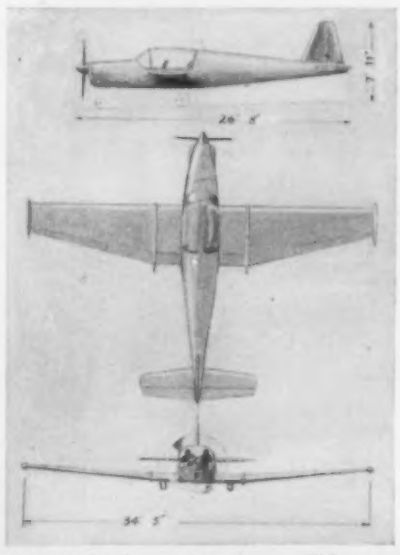
Flight Safety Group To Aid Business Flyers

The Flight Safety Foundation is receiving strong backing from corporate aircraft users for its new program of providing technical guidance and liaison for business flyers on important operational and safety problems.

Some three dozen corporations already have made financial contributions to help FSF expand its new services, an FSF spokesman told AVIATION WEEK. The Foundation tentatively plans to hold its first forum for business pilots and operators sometime next month. The meeting place has not yet been determined but the leading contenders at present are New York and Cleveland.

The new department collects information from corporations on operating procedures, maintenance problems, mechanical troubles and their remedies. The material is correlated and circulated among business flyers for their guidance. Also FSF, with its numerous contacts with airlines, industry and government agencies, can keep members posted on developments relating to their operations, using material collected as a result of its overall advisory functions.

A corporation pilot told AVIATION WEEK that there has long been a need for such a "clearing house" that would guide business plane users, particularly in maintenance, safety and operating procedures. "We used to get a lot of help from our friends in the airlines," he said, "but now they are flying newer and faster equipment and they don't have the same problems anymore." He noted that corporation flyers had tried



THE BI-502 four seater, above, will become Germany's first postwar production aircraft. Tests begin early next year.

FIERY!

MOODBEAMS # 9

Candy Barr is firing a two-gun salute for a double-barreled reason:

(1) SAC beat its 150-day deadline with USAF jet engine overhauls and now is moving ahead with third-month production, and

(2) The shop, as usual, also is doing a great job for piston engine owners and Sept. 21 will join Pratt & Whitney Aircraft in a gala Engine Forum at Dallas.

P.S.: Candy will be at the Forum party — all green-eyed, blond-haired, 5' 3½", 122 lbs. of her!

Southwest Airmotive COMPANY

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Integrated

New system provides simpler, more pictorial cockpit information

MORE FLIGHT DATA, in clearer visual form, in less space . . . this is a modern cockpit need now answered by Sperry instrument specialists. With the Sperry Integrated Instrument System, three new instruments are incorporated into the basic six now in common use, giving the pilot more of the data he needs—simply, conventionally, pictorially—without increasing the number of instruments on his panel.

The Sperry Integrated Instrument System consists of a more accurate and reliable primary direction instrument, a combined flight director and gyro-horizon, and a pictorial deviation indicator. Manual control of higher performance aircraft—through all phases of VFR and IFR flight plans—can be an orderly, efficient procedure with these panel aids.

NEW THREE IN BASIC SIX

Model C-6 Gyrosyn* Compass uses a master indicator with RMI (Radio Magnetic Indicator) presentation and data transmitters for providing accurate heading information to other equipment. A settable course marker also serves as the heading selector for the flight director. Model C-6A Gyrosyn Compass is also available with integral switch for selecting input to radio pointers.

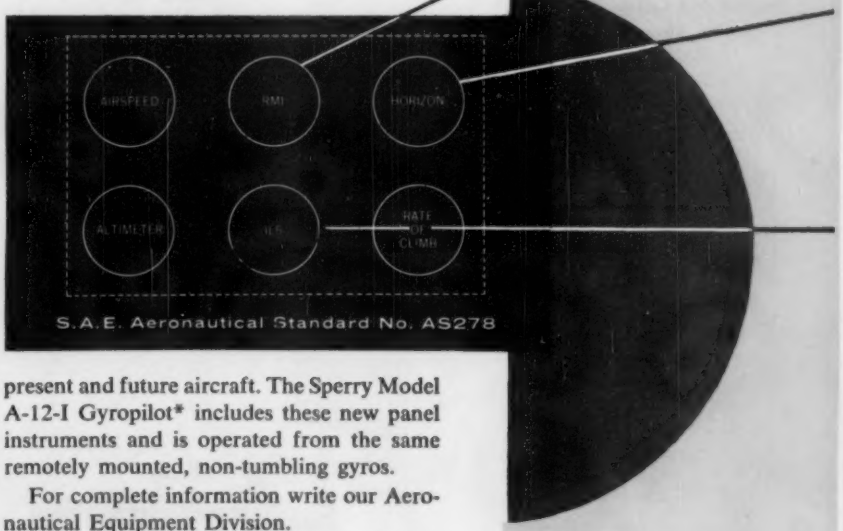
Model HZ-1 Horizon Flight Director is a pictorial horizon with conventional sensing, effectively combined with the well-known Sperry Zero Reader* Flight Director. The non-tumbling horizon is graduated to ±90° in pitch from level flight and provides pitch and roll attitude information at all times while flying "zero" on the Flight Director. When not in use the Flight Director pointers can be retracted from view.

Model R-1 Pictorial Deviation Indicator displays aircraft position with respect to ground radio facilities. It includes a new pictorial presentation of the TO and FROM zones of VOR, and an omni-bearing selector. On ILS it provides both glide path and localizer deviation.

The System also includes a new lightweight, transistorized computer for more stable coupling to ILS during manual approaches. This Model Z-4 Flight Director Computer is completely free from the effects of cross-winds and varying pitch attitude resulting from changes in speed and loading.

The Integrated Instrument System is flexibly adaptable to all types of installations for present and future aircraft. The Sperry Model A-12-I Gyropilot* includes these new panel instruments and is operated from the same remotely mounted, non-tumbling gyros.

For complete information write our Aeronautical Equipment Division.



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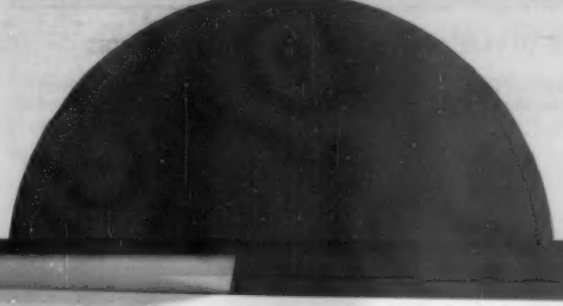
INSTRUMENTS SHOWN ACTUAL SIZE

Instrument System

MODEL C-6

MODEL HZ-1

MODEL R-1

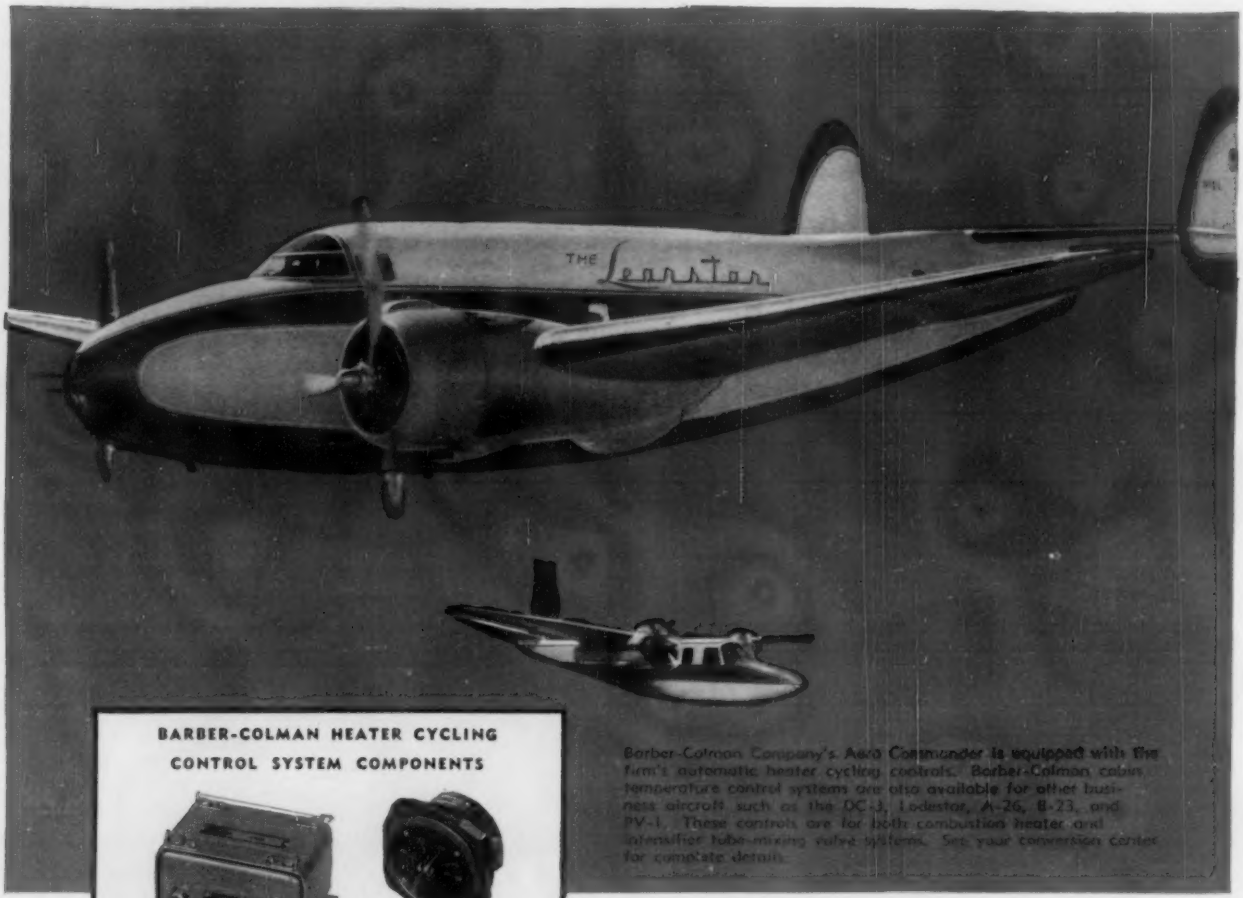


BARBER COLMAN

Aircraft Controls

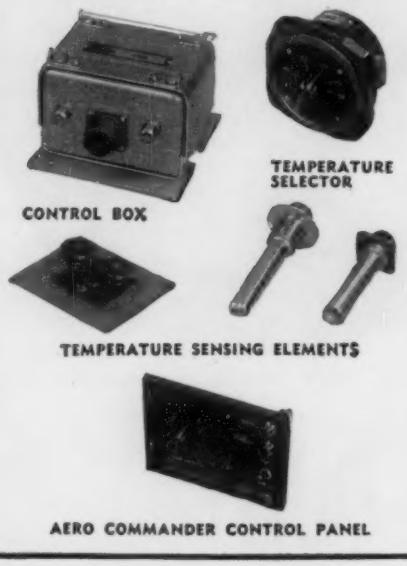
. . . chosen for new Learstar executive transport temperature control system

Built entirely to airline standards, the new twin-engine Learstar offers business firms an executive aircraft with outstanding speed, range, safety, and comfort features. And, as on all leading commercial airliners and the majority of multi-engine business aircraft, an automatic Barber-Colman cabin temperature control system has been selected as standard equipment for the Learstar. This system automatically cycles the combustion heater to maintain selected cabin temperature within plus or minus 2° F. Thus, Learstar passengers are assured comfort aloft . . . just as are the many others who travel via the hundreds of Barber-Colman equipped multi-engine business aircraft operated by some 225 individual firms throughout the world today.



Barber-Colman Company's Aero Commander is equipped with the firm's automatic heater cycling controls. Barber-Colman cabin temperature control systems are also available for other business aircraft such as the DC-3, Lodestar, A-26, B-23, and PV-1. These controls are for both combustion heater and intensifier tube-mixing valve systems. See your conversion center for complete details.

BARBER-COLMAN HEATER CYCLING CONTROL SYSTEM COMPONENTS



The complete line of Barber-Colman aircraft controls includes: Temperature Controls; Actuators; Positioning Controls; Electric and Pneumatic Air Valves; Thermo-Sensitive Elements; Sub-fractional hp Motors; Ultra-Sensitive Polarized Relays. Complete catalog available . . . send for yours. When you have need for highly dependable controls, specifically designed for your application, consult Barber-Colman Company. Engineering sales offices in Los Angeles, Seattle, Baltimore, New York, Montreal.

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unsuccessfully to enlist the aid of several organizations in the problem.

When the aviation manager of a large corporation submitted the proposal to the Flight Safety Foundation, it received immediate and enthusiastic response from managing director Jerome Lederer who had been thinking along the same lines for some time. The job itself has been assigned to Randall H. Carpenter, manager of FSF's Air Transport Division and on leave of absence as an American Airlines captain. The activity is based at the Foundation's headquarters, 471 Park Ave., New York City.

Carpenter said the activity will maintain a neutral stand on inquiries about new equipment. It will, however, check the requirements for such equipment and pass them along to the potential user for use in evaluating available types.

The foundation also can establish contact with manufacturers for business plane users on special problems. Carpenter mentioned one case where a corporation wanted to replace fire detection gear it was using with something more modern. However, the type it wanted was not yet commercially available.

Through FSF, the comporation obtained the necessary drawings and specifications and had the equipment made by another firm.

Flight Safety Bulletins

Air safety bulletins index for 1954, including business pilots notes, is being issued by Flight Safety Foundation Inc., 471 Park Ave., New York 22, N. Y.

C-123 Begins Suitability Tests

Fairchild C-123 assault transport on down-wind landing shaves a 50-ft. barrier marker as operational suitability tests are begun at Air Force Proving Ground Command, Eglin Air Force Base, Fla. The C-123 is designed to land and take off in front-line areas on short, unimproved runways, bringing in supplies and evacuating the wounded.

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*Trademark for a basic Marion moving coil mechanism. Patents pending.

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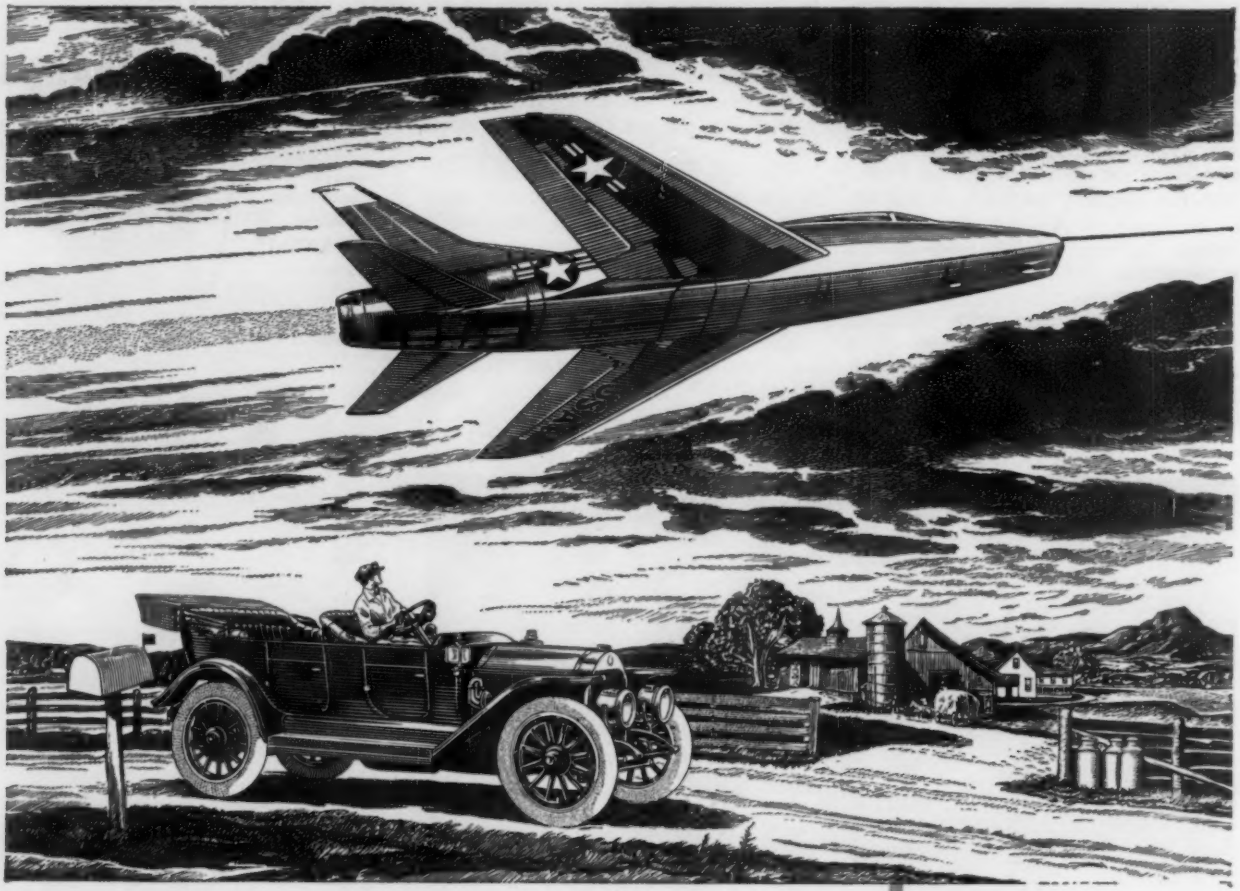
From the Stoddard-Dayton to the Super Sabre



Speco's creative engineers have opened new horizons in precision!

If you recall the Stoddard-Dayton, then surely you remember the Jenny – the sweetheart of World War I. They were a couple of kids who "grew up together" . . . the car and the airplane. And today their grandchildren are the mainstays of our national economy.

We like to feel that our leadership in precision on a mass production basis has played a big role in this growth. Our work in all industries—automotive, aviation, industrial . . . in fact, in all fields of mechanics and hydraulics – has made great contributions. Our team of precision engineers, toolmakers and machinists makes certain that *If We Ship It . . . It's Right!* If you have a job with which you feel we might help, a short letter or a telephone call will bring prompt, sound guidance. Or if you'd like the whole SPECO story—from plant to people to products, send for our new Plant Brochure. The Steel Products Engineering Company, Springfield, Ohio.

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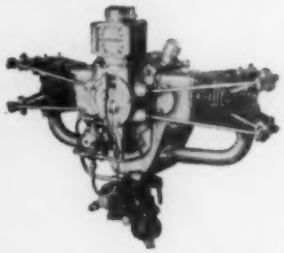
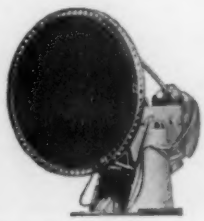


One of our early contributions to aviation—this two cylinder, Opposed Piston Blower Engine produced by Speco in 1924.



Today we're building precision mounts for nearly every major manufacturer of radar equipment—and many other component parts.

PRIVATE LINES

Riley '55 twin-engine Navion recently was ferried across the North Atlantic by Fleetway Ferrying Service with a normal fuel load. Only change was the addition of some low-frequency transmitting and receiving equipment. The twin-Navion was purchased by the Oerlikon Tool & Arms Corp. of America for a subsidiary—the Contraves Co., of Zurich, Switzerland.

Bladder fuel cells in center section and outer wings and a capacitance-type gaging system are features of a Firestone Tire & Rubber Co. Lockheed Lodestar which was converted by Temco-Greenville, Tex. This is the first of several Firestone Lockheeds to get the new features.

Scintillation Counter SC188DA for airborne use in locating uranium features dual level discrimination against high and low energy radiation for limited spectral selection and synchronous logging of absolute altitude and counting rate with dual recorder. Rates of 200 counts/sec. per microroentgen/hr. and higher are stated to be available. Mt. Sopris Instrument Corp., 1320 Pearl St., Boulder, Colo.

North American Van Lines, Inc., Ft. Wayne, Ind., has purchased a Beech Super 18 to replace an earlier Twin Beech. Company President James D. Edgett says he flies approximately 3,000 mi. a month in the firm's plane . . . Harold S. Vanderbilt has purchased a 12-place Learstar equipped for transocean flights.

Radar installation developed for Learstar is expected to improve the business plane's aerodynamic characteristics and increase cruise speed by several miles per hour, Lear Aircraft Engineering Division, Santa Monica, Calif., reports. Transmitter-receiver is installed in approximate center of radio rack immediately aft of the scanner to hold length of wave-guide to a few inches for minimum signal loss. Lear has two Learstars in the shops getting the installation using Bendix RDR-1B X-Band with Racon Station plotting. Installation is also applicable to Lodestars, Venturas and Hudsons, Lear notes, and it expects to make a field kit available soon.

Airport development plan for Denver's Stapleton Airfield is being studied by city officials. The proposal asks an expenditure of $4.5 million by 1960—$3 million for runway extensions and

NEW Model 36128 Rate Gyro is a rugged, medium size, oil damped unit, designed for aircraft and missile control or telemetering. This high accuracy instrument is enclosed in a hermetically sealed case and is optionally available with an internal thermostatically controlled heating element for constant damping over a wide range of environmental temperatures. The Gyro operates from a 3 phase 400 cycle power source (26V, 115V, 200V), and is available with either a noble metal precision potentiometer or synchro pickoff. High level electrical outputs proportional to angular velocity are available from either pickoff and can be used directly for recording, control, or indicating purposes, with little or no amplification. ■ This instrument is available in a wide variety of operational ranges of from 15 to 250 degrees per second and with damping ratios between 0.5 and 0.6 of critical. Built-in mechanical stops prevent excessive gimbal over-travel and prevent damage due to velocities beyond rated range. Terminals or plug can be furnished at either end. Because the inner mechanism is floated in oil, this Gyro is capable of operating under extreme conditions of vibration and shock. Size: 2 in. dia. x 2.5 in. long.

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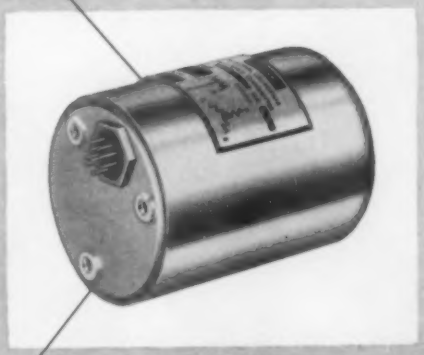
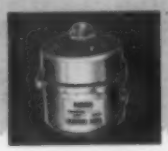


DIRECTIONAL GYRO MODEL 3211



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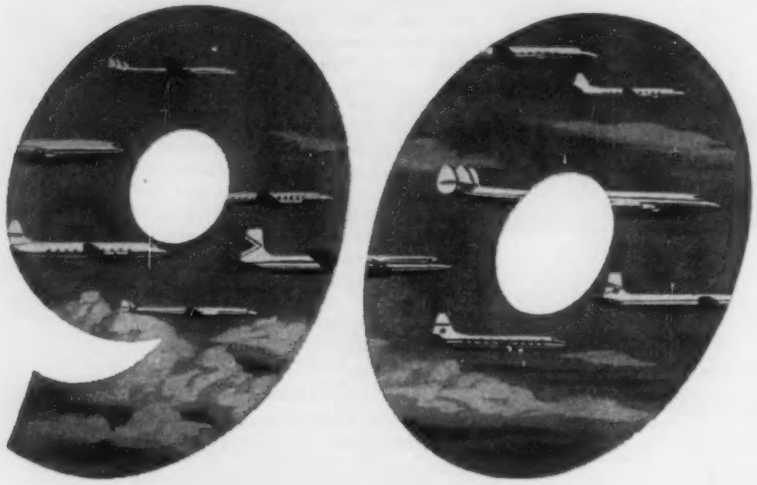
Measure and Manage Fuel on



Types of Aircraft and

Airlines

Now making headlines are two of the world's newest and finest transport aircraft – the VISCOUNTS flying for Trans-Canada Air Lines and Capital Airlines, and TWA's SUPER-G CONSTELLATIONS. Both of these aircraft are equipped with Simmonds Pacitron Fuel Gage Systems.

Simmonds Fuel Gage Systems are today flying on more than 90 types of commercial and military aircraft and on 40 domestic and foreign flag airlines; only Simmonds can make this claim to being "first in electronic fuel gaging."

In addition to dependable fuel measurement, the Simmonds Pacitron Fuel Gage System makes possible the addition of important functions of fuel management and control, such as: automatic load limit control, center of gravity control, and low level switching. For a record of dependable performance that matches the new high performance aircraft, look to Simmonds.

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improvements, the remainder for terminal and hangar development.

New takeoff fees for aircraft not based at Westchester County Airport have been effected: 2,500 lb., $1; 7,500 lb., $1.25; 12,500 lb., $2.50; 20,000 lb., $3.50; 30,000 lb., $5; 50,000 lb., $7.50; 75,000 lb., $10; 100,000 lb., $15; 125,000 lb., $20; over 125,000 lb., $25.

Piper employes returned to work at Lock Haven, Pa., Aug. 22 following strike which began Aug. 1. Average wage increase including employe benefits amounts to 15 cents/hour. Some 1,400 employes were idled during Piper's first postwar walkout except for a one-day stoppage in 1946. At time strike started Piper was producing eight single-engine planes daily and approximately 35 Apaches monthly.

Lockheed Lodestar conversion by Wiplinger Aircraft, Fleming Field, S. St. Paul, Minn., has a true airspeed of 258 mph. at 700 hp. at 10,000 ft. Fuel consumption at this performance is stated to be 105 gph. Planes feature retractable tail wheels, picture windows and pressure-sensitive tape soundproofing throughout the fuselage. Wiplinger has five Lodestar conversions in its shops, with one each slated for Sangamo Electric Co., Springfield, Ill., and S. J. Groves & Sons, Minn., the second for each firm.

New Continental engine distributor is General Aircraft Supply Corp., Detroit City Airport, Mich.

New Rumanian Routes

Vienna—The Rumanian government has inaugurated a number of domestic air routes and reactivated another during the summer months in an apparent attempt to follow the lead of the Soviet Union which recently placed increased emphasis on airline expansion within its own borders.

Rumanian routes known to have been recently started include:

- A line between Bucharest and Constanza, the major Rumanian port, by the Rumanian Air Transport Corporation with daily runs over the 55-minute route. The new flights are scheduled for the late afternoon.
- A line between Bucharest and Brasov, now known as Stalin, has been reactivated. The route was closed last year when the joint Soviet-Rumanian "TARS" airline was dissolved by the two countries.
- A new connection between Bucharest, Sibiu and Stalin City.
- A line between Bucharest, Sibiu and Deva.

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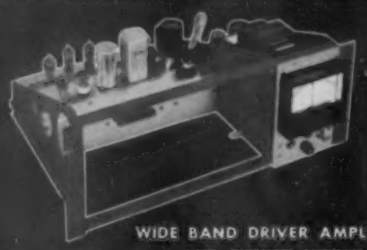
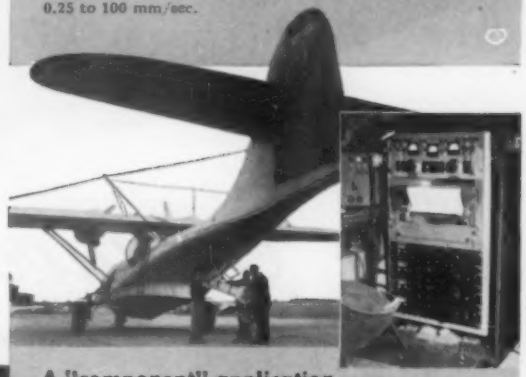
● SEPARATE COMPONENTS



WIDE BAND DRIVER AMPLIFIER AND POWER SUPPLY

THIS amplifier (Model 150-300/700) is designed for use with low power galvanometer elements (output ±25 ma full scale into 100 ohm load), an oscilloscope and/or a panel meter, individually or simultaneously. Eleven plug-in type, interchangeable Preamplifiers are available for use with it, and include: AC-DC, Carrier, DC Coupling, Servo-Monitor, Log-Audio, Low Level, Input Network, AC Wattmeter, Frequency Deviation, Stabilized DC, and an RMS Volt/Ammeter.

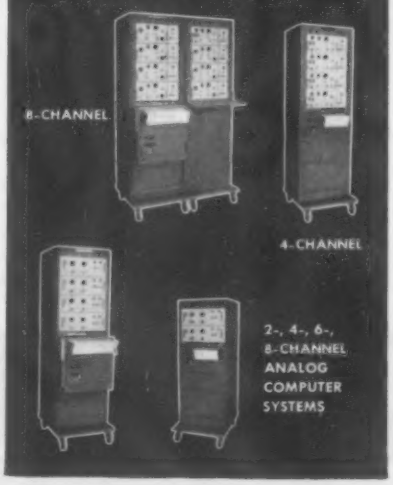
Other available separate components include Recorder Assemblies from 1- to 8-channels, with chart speeds from 0.25 to 100 mm/sec.



A "component" application

FOUR Model 67-300 DC Amplifiers and a Model 154-100 four-channel Recorder Assembly are integrated with other equipment aboard a "flying geophysical laboratory" by PSC Applied Research, Ltd. of Toronto to record data from dual frequency detector magnetic survey equipment and a radiation detector, plus elevation variations during flight. The simultaneous recording of all four provides valuable reference data when interpretations are being made.

● COMPLETE SYSTEMS



A Sanborn "150" system starts with a choice of an 8-, 6-, 4-, 2- or 1-channel basic assembly, to which the user adds any combination of plug-in type Preamplifiers to meet the numerous and changing recording requirements. Special 8-, 6-, 4-, and 2-channel systems are available for recording the output of analog computers, or other applications involving 1 volt cm sensitivity. Added to this application versatility and operating flexibility of Sanborn systems are other advantages, such as inkless recording in true rectangular coordinates . . . high torque (200,000 dyne cm) galvanometer . . . time and code marking . . . numerous chart speeds.

Let Sanborn engineers help you solve your recording problems. Write for complete specifications and performance data on any Sanborn component or system.

SANBORN COMPANY
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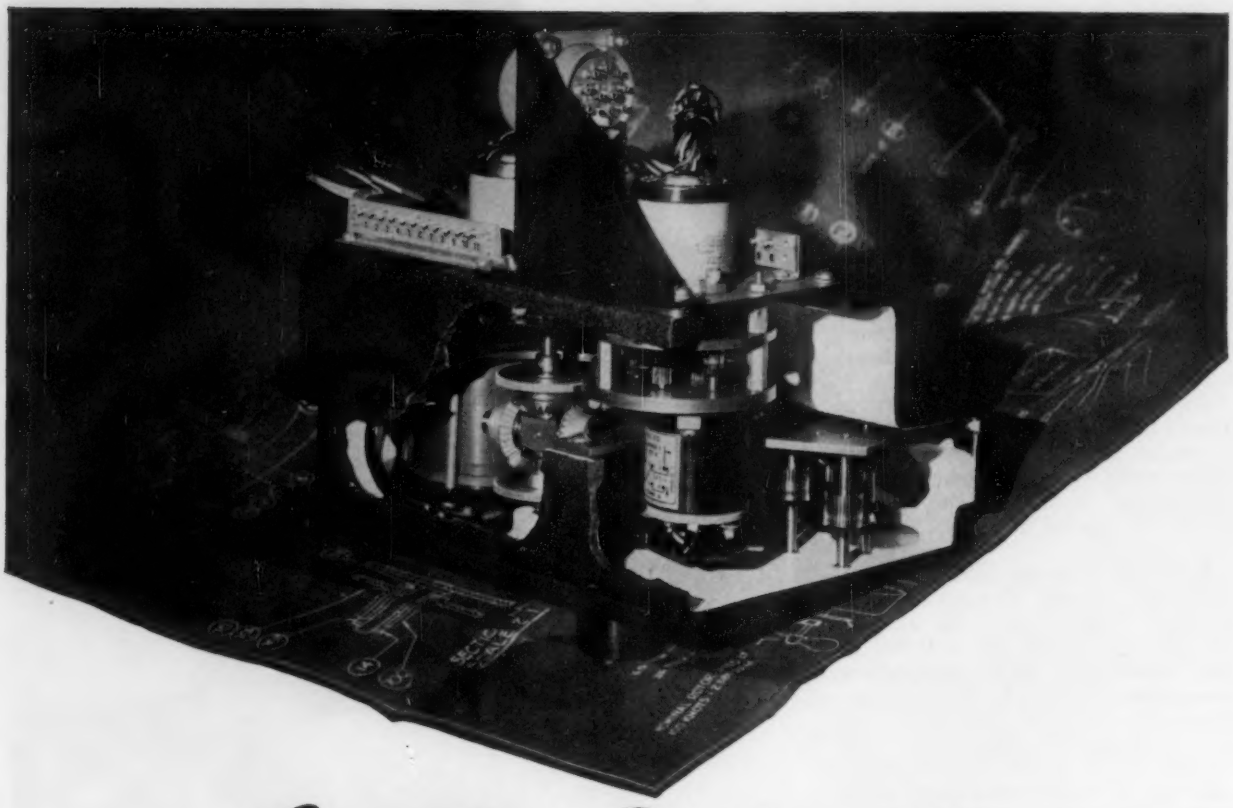

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OF ELECTRO-MECHANICAL ASSEMBLIES . . .
FROM "PILOT STAGE" TO PRODUCTION EFFICIENCY

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You bring your designs to us. Atlas experienced production and methods engineers layout the job using new cost-cutting methods, improved processing techniques. Atlas toolmakers build dies and fixtures to implement these plans. Atlas skilled mechanics and assemblers produce prototypes to your exact specifications. Atlas metallurgical and electronic technicians test your product. Your next step is when your plant or Atlas takes over for volume production.

Atlas furnishes the practical engineering step between idea and production line. We've been "precision-eering" on a contract basis for many years. May we work with you? Write for booklet "Precision-eering Electro Mechanical Equipment." ATLAS Precision Products Co., Phila. 24, Pa. (*Division of Prudential Industries*).

"From Drawing Board . . . to Production Line"

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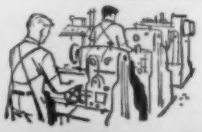

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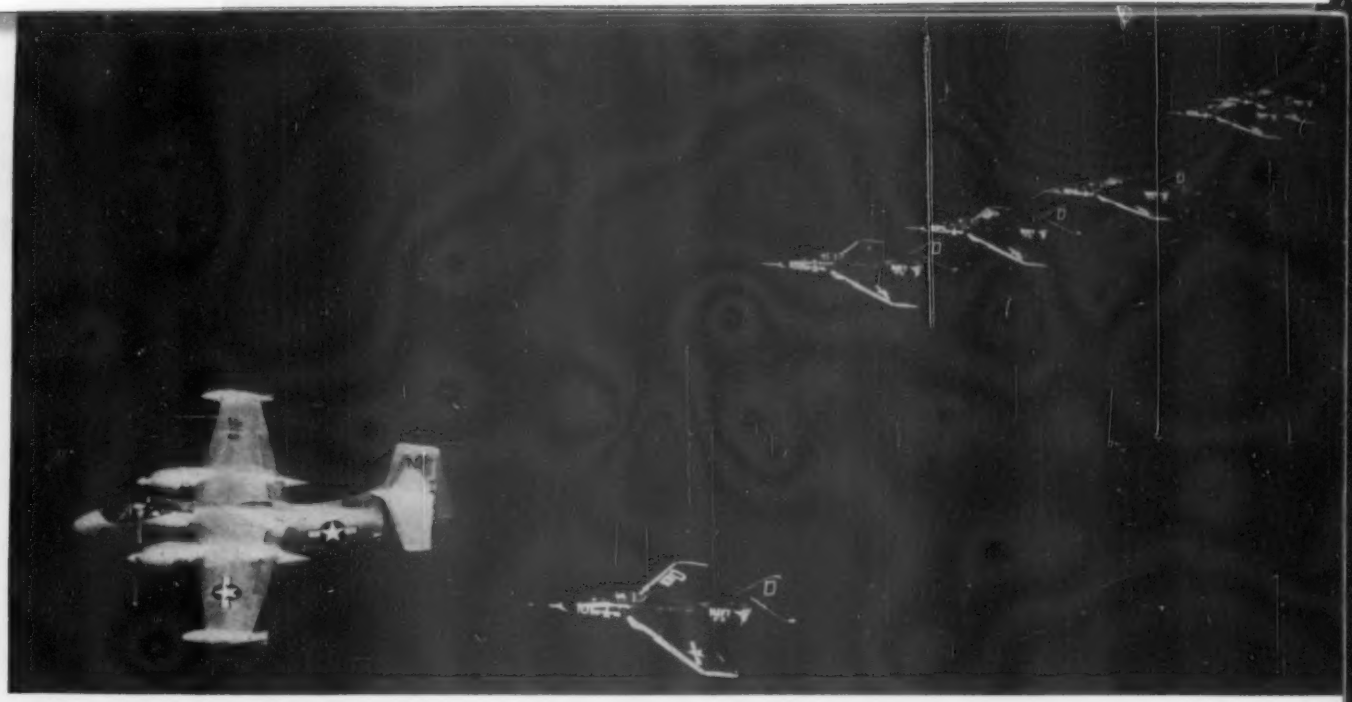


Congestion at the Gas Station

F9F-8 Navy jet fighters "line up" behind AJ "Savage" tanker over Pacific as Squadron 121 based at the Miramar Naval Air Station, San Diego, completes its qualification flights in air-to-air refueling. In qualifying all its pilots in the art of the maneuver, the squadron suffered only one setback. A pilot was refueling his F9F-8 when the hose snapped at a point between the jet and tanker. With 40-ft of hose in tow, the officer managed a successful landing.

CAA Plans to Give Air Industry Greater Say in Safety Regulations

Washington—The Civil Aeronautics Administration plans to place additional responsibility on the aircraft industry for compliance with safety standards and regulations and reduce its own activities in this field.

The CAA says there is no question but that some safety promotion and regulation activities can be eliminated, delegated or transferred to industry without adversely affecting the present high level of safety.

The future role of CAA is presently depicted as that of counseling and advising the industry in good operating and safety practices while exercising only a surveillance system of compliance by industry.

The CAA proposals to delegate certain functions in the aviation safety field to responsible segments of industry is now being circulated to industry groups and trade associations. Industry representatives have been asked to meet with CAA officials for informal discussions prior to the submission of formal comments. This course of action was suggested since the proposed program is only a basis for discussions with industry.

The program is presented in the form of a committee report by the Office of Aviation Safety on "Industry Safety Responsibilities." This committee was appointed by Al S. Koch, Aviation Safety Director, to develop proposals to implement the President's budget message in which the President said:

"With the increasing maturity of civil aviation, the federal government soon should be able to reduce substantially its safety promotion and enforce present high level of safety. I have requested the early preparation of a plan, in cooperation with industry, to achieve this objective."

The committee consisted of W. H. Weeks, Chief, Aircraft Engineering, as chairman; E. B. Franklin, Chief, Air Carrier Safety; E. W. Hudlow, Chief, General Safety, and Dr. W. R. Stovall, Chief, Medical Division. A final report was completed by the Weeks Committee on June 15 but was held up as "administratively restricted" for two and a half months.

The report is broken down into four parts covering activities in each of the four divisions comprising the Office of Aviation Safety—Air Carrier, General Aviation, Engineering and Medical. In each area, it is proposed that certain functions be eliminated, delegated, transferred or retained by CAA, as the case may be.

A majority of the various changes would require Civil Aeronautics Board approval; would necessitate legislation, while others could be administratively implemented. Recommendations of the committee are as follows:

Aircraft Engineering

CAA should not continue to make detailed and routine compliance checks of aeronautical products. This activity could be delegated and/or transferred to an industry which is now largely capable of making such determinations. Such action is necessary due to the tremendous growth and increased complexity of the aviation industry which makes a corresponding increase in the size of CAA in these activities economically impractical.

It is believed that none of the basic aircraft engineering functions can be eliminated entirely but that there is room for "delegation" rather than "transferral" of responsibility. Leading item of proposed delegation lies in the area of type certificating of new aircraft.

Here it is proposed that the responsibility for proving compliance with Civil Air Regulations be delegated to "manufacturers of proven capabilities." This would also be true for engines and propellers.

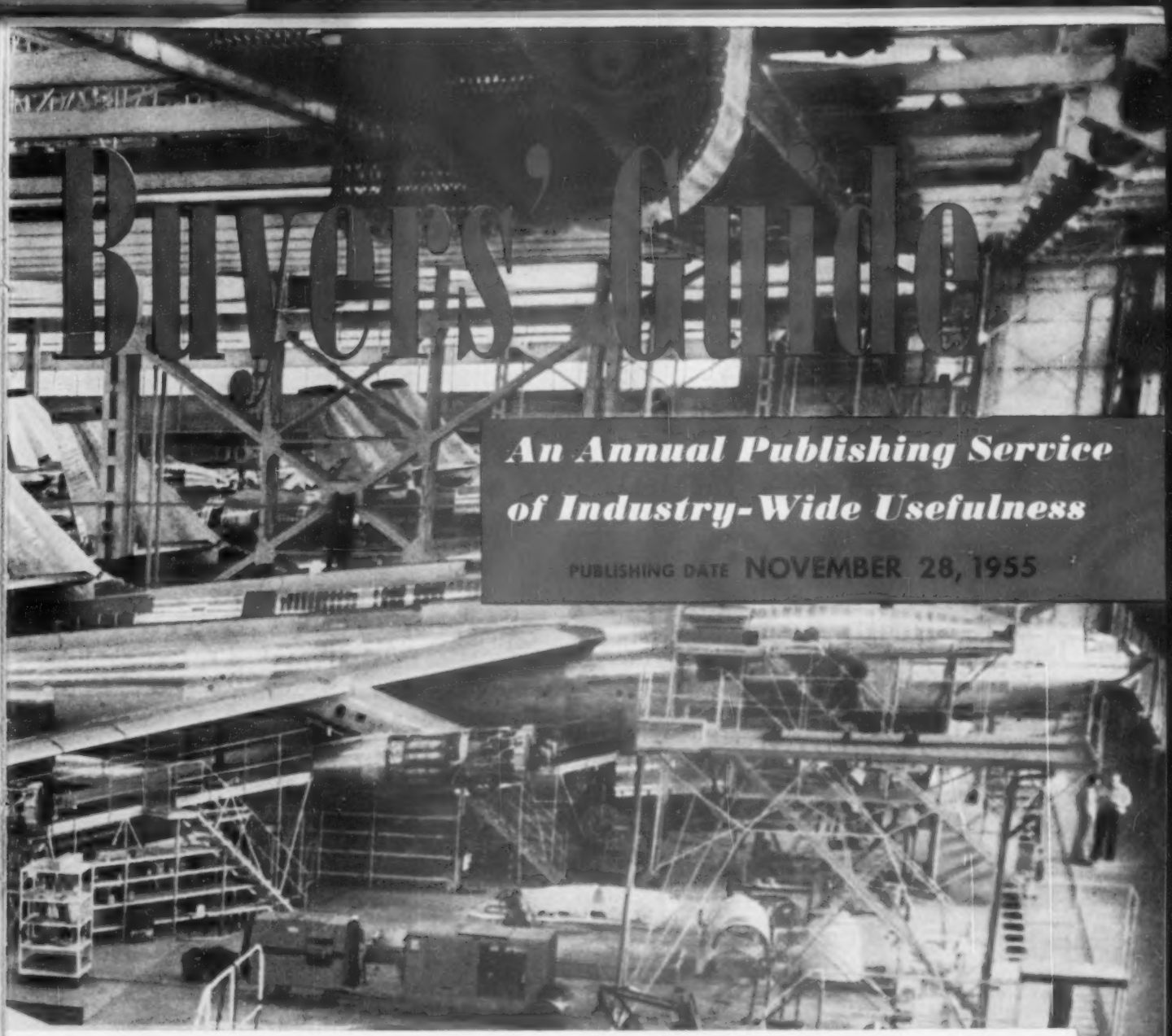
Other aircraft engineering activities that it proposes to delegate include:

- **INDUSTRY-DEEP** Penetration Through Aviation Publishing's Largest Circulation

- **KEY** to the Major Buying Influences in the Multi-Billion Dollar Aviation Market

November 28, 1955, an all-important, needed publishing service will be available to the aviation industry . . . AVIATION WEEK's Annual BUYERS' GUIDE. The dramatic development of aviation into today's multi-billion dollar giant—reaching into all phases of manufacturing—demanding a constant flow of products and materials from tens of thousands of separate suppliers—has made a comprehensive, complete source book of suppliers and manufacturers a must for all segments of the Industry. AVIATION WEEK's BUYERS' GUIDE answers this intelligence need with an information service of year-'round usefulness, placed directly into the hands of some *57,000 key aviation engineers, management men, design and purchasing personnel—men who make up aviation's real buying influences . . . in the industry itself, in the Air Force, and throughout the Government.

The latest developments in military procurement will be covered in a special report. Included in the detailed information to be presented will be: Air Material Command—Air Research and Development Command buying practices, personnel listings—by name, procurement centers, etc.; All-inclusive listings of manufacturers of aeronautical and allied products, sectionalized for maximum utility under six major headings: **Aircraft;** Airframe and components, Armament, Fixed Equipment, Landing Gear, Powerplant. **Missiles;** Airframe and components, Equipment, including ground-handling, Powerplant. **Avionics;** Communications systems and equipment, Radar-fire control systems and equipment, Instrumentation and controls, Navigation systems and equipment, Components and devices, Test equipment, Computers and data processing equipment in airborne, ground-based or shipboard applications. **Supporting Groups;** Data systems, Electrical, Ground equip-



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* Average net paid circulation, 51,893 (June, 1955 ABC Statement). Paid circulation of current weekly issues more than 53,000. Current weekly print order exceeds 57,000.

AVIATION WEEK

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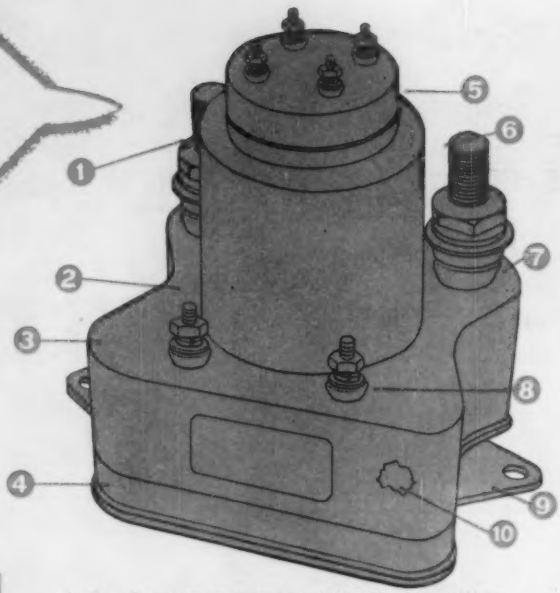
Cutler-Hammer Hermetically Sealed Relays



1. Low Terminals cut Length and Weight of Lead Wires —Interchangeable with Class 0 Relays. 2. Coil gives Maximum Heat Transfer. 3. Low Center of Gravity. 4. Completely Environment-Proof—Non-Corrosive and Fungus-Proof. 5. N.O. & N.C. Auxiliary Contacts Available. 6. Wide Terminal Spacing. Socket Wrench Clearance. 7. High Dielectric and Recovery of Glass. 8. No. 6 Studs allow Same Lead Wiring as Unsealed Class 0 Relays. 9. Single Pole Relay Mounting Permits Easy Replacement of Unsealed Class 0 Relay with New Design. 10. Operable with Hole in Case. Does Not Rely on Artificial Atmosphere.

Setting new standards for dependability in electrical control for aircraft

C-H Class A Relay operates in ambient temperatures up to 71° C. *No* Auxiliary Contacts.

C-H Class B Relay operates in ambient temperatures up to 120° C. Available with auxiliary contacts.

Both Class A and Class B Relays meet the requirements of "Report of Advisory Staff for Aircraft Electrical Systems—April, 1951". Operate at 80,000 feet. Class A withstands vibrations 10 to 500 cps, 10 g. Class B to much higher than 500 cps. Light weight design. Continuous duty coil.

The new Cutler-Hammer Hermetically Sealed Aircraft Relays are the culmination of years of intensive development and research by Cutler-Hammer engineers in close cooperation with leading aircraft builders. They meet the present and future need for environment-free devices for use in higher ambient temperatures with the ability to better withstand shock and vibration. They offer longer trouble-free life and contribute directly to increased safety.

Only permanent non-aging materials are used in these new relays. All metal parts (except those carrying current or those in the magnetic structure) are stainless steel. The stainless steel case is covered *both outside and inside* with a specially developed blue glass fused thereto at extremely high temperatures. This glass was developed to have the same coefficient of expansion as the metal to which it is bonded, is chip-proof under even rough handling, and has great dielectric strength with maximum recovery should a flashover occur. Special high-strength terminals are used, glass-bonded to case. Cases are filled with a special inert gas and are 100% inspection-tested by the mass spectrometer method for a positive hermetic seal.

These new relays have been standardized to be generally interchangeable with presently-used unsealed relays. This Cutler-Hammer line is also being extended continuously as to types and capacities available. Be sure you have the latest data and are listed to receive promptly all new information as it is released. Write or wire today. CUTLER-HAMMER, Inc., 1471 St. Paul Avenue, Milwaukee 1, Wisconsin.

What you should know about Cutler-Hammer

Cutler-Hammer has long held the respect of the aircraft industry because this company has been *part* of the aircraft industry for 35 years. It has never been an opportunist supplier. It has *pioneered* the designs others have followed. It has sought to serve, not merely sell. It has been in the forefront of all cooperative activity in standardization and long-range planning. It has supplied complete *lines* of equipment, not merely the items of widest use and most profitable manufacture. Today, as for the decades past, Cutler-Hammer engineers are working closely with the aircraft industry's leaders . . . thinking ahead, planning, designing and building for the future. Here is the record:

1920 Cutler-Hammer designed and manufactured the first line of switches ever created specifically for use in aircraft.

1938 Cutler-Hammer designed and manufactured the first d-c power relay ever created specifically for use in aircraft.

1943 Cutler-Hammer designed and manufactured the first a-c power relay ever created specifically for use in aircraft.

1949 Cutler-Hammer started development of the first environment-free power relays for use in aircraft.

1953 Cutler-Hammer submitted samples and certified test reports on the first hermetically sealed power relay to WADC and Bu. Aer. Cutler-Hammer configuration adopted as industry standard by ASG.

CUTLER-HAMMER
AIRCRAFT CONTROL
C-H

- **Production certification**
- **Certification** of foreign aircraft.
- **Approval** of design changes.

Those activities that might be transferred embrace the development of international airworthiness standards; aircraft operators and manufacturers reporting service difficulties on a mandatory basis; manufacturers furnishing specifications with each aircraft which would relieve CAA of issuing aircraft specifications, and for gliders, not used for hire, development of, and compliance with, standards would be handled by an industry association.

In those safety areas, which are the basic responsibility of industry, the role of the air carrier safety division should be limited to the surveillance and evaluation necessary to insure that management and personnel are doing their jobs. Thus, two air carrier safety functions could be eliminated: (1) inspections for reissuance of airworthiness certificates; (2) observation of electronics equipment type certification tests.

CAA activities in this field which would be transferred:

- **Determination** of adequacy of airports used by carriers operating under Part 40 or 41 certificates.
- **Special flight** authorizations, such as ferry permits.
- **Adequacy** of weight and balance procedures.

It is further proposed to delegate the authority for examination of applicants for air carrier airman certificates and for control tower operator certificates. Also, CAA would delegate responsibility to air carriers for establishing their own overhaul and inspection time limitations.

In the field of general aviation, CAA suggests eliminating annual inspection of small aircraft, issuance of waivers to agricultural and industrial operations and air shows and discontinuance of airman identification cards. Because of general aviation's continued expansion and the diversity of new uses, CAA intends to meet the complicated problem of administration through the use of qualified designees. There should be less effort on individual certification actions. CAA does not have the limits and resources to cope with aviation on an "individual" basis.

The development of medical standards is regarded as a CAA responsibility. However, compliance with medical standards is regarded as the responsibility of the individual. None of CAA's medical functions were suggested for elimination at the present time.

Initial industry reaction to the specific proposals for CAA's shifting responsibilities in the field of aviation safety was mixed. The committee report, although not yet an official CAA proposal, is the definite basis for eventual changes.

LETTERS

Republic Modelers

It was with a great deal of interest that we read the letters concerning airminded youth ("Models & the McCoy" July 25, p. 31; "More on Models," Aug. 15, p. 113).

While it may be true that the industry as a whole does not support the efforts of airminded youth, Republican Aviation Corp. is playing an active part in promoting the building and flying of models as a hobby for young and old.

The Republic Aviation Model Society (an AMA chartered organization) is made up of Republic employees (100% AMA membership). The aim as described in the RAMS constitution is to "create understanding, promote interest, invite competition and aid in the development of the hobby." This is adequately illustrated by the number of events that the RAMS have conducted. . . .

Probably the best-known is the Annual Long Island Industrial Championships. This contest draws entries from Connecticut, Pennsylvania, New Jersey and this year we even had a contestant come up from Florida. We are all very happy and proud of the Class B world speed record which was established this year at the LIIC by a youngster from Brooklyn, New York.

In addition to the contests we run, there

(Advertisement)

Aero Supply Mfg. Co. Inc. of Corry, Pa., announces a series of general engineering data bulletins of a non-advertising nature prepared by Aero Supply's Research and Development Center recently established in Cleveland, Ohio. The bulletins consist mainly of technical data with charts, graphs and other valuable information related to the design of aircraft, rocket and missile fuel systems.

The first four bulletins show viscosity vs. temperature data for approximately 120 different fluids and has been prepared for availability on or about September 6, 1955. Subsequent bulletins will appear at approximately one month intervals.

For over 39 years Aero Supply Mfg. Co. Inc. has been a leading designer and manufacturer of fuel system components, cockpit controls and related articles for all flight applications. Qualified representatives and engineers are readily available upon request to offer assistance on specific engineering and application problems.

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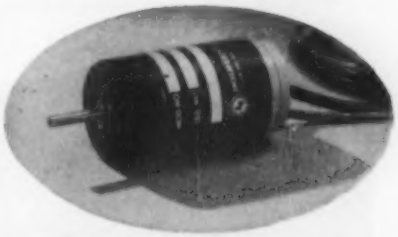
FIRST MK 4 MOD O EQUIVALENT SIZE 11 PRECISION INDUCTION RESOLVER!

Available Immediately!



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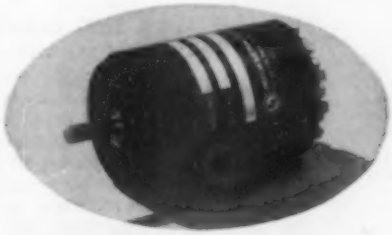

SIZE 15—Mark 4 Mod 0 Equivalent with accuracies and phase shift better than specified!

SIZE 23—Exceptionally high functional accuracy—better than .05%. Perpendicularity better than ±3 minutes.

ALSO AVAILABLE—All American Electronic SIZE 11, 15 and 23 Resolvers may be obtained with: HIGH IMPEDANCE NETWORK COMPENSATION, PARTIAL OR COMPLETE WINDING COMPENSATION, BROAD BAND, HIGH FREQUENCY RESPONSE.

Complete line of SERVO MOTORS, GEARED SERVO MOTORS, MOTOR TACHOMETERS, BRUSHLESS INDUCTION POTENTIOMETERS, MINIATURE SYNCHRONOUS MOTORS; *low and high temperature models.*

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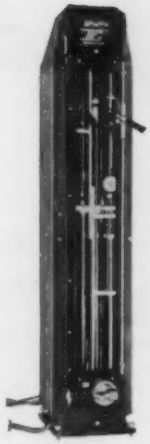
pre-cise (prē-sīs'), adj.; exactly or sharply defined or stated, not vague, minutely exact, reliable, not varying in the slightest degree from accuracy, standard, etc.

A fitting description of Ideal-Aerosmith test equipment. High engineering standards and rigid quality control production methods assure the reliability and minute exactness required by the industry today.

IDEAL PRECISION BAROMETER-CONTROLLERS PROVIDE AN ACCURATE METHOD OF CALIBRATION. Furnishing a range from 0″ to 100″ Hg, Ideal barometer-controllers can be used for precision calibration of such equipment as absolute or differential pressure sensing pptentiometers; air data computer transducers; force balance system components; altitude controllers and switches; altitude transmitters; standard pressure activated aircraft instruments, such as sensitive alimeters; and in special applications, sensitive or true airspeed indicators and transmitters, machmeter indicators, machnumber transmitters.



Barometer-Controller
Model 10-64-30

Servo-Valve Unit for
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Micro Reader Unit for
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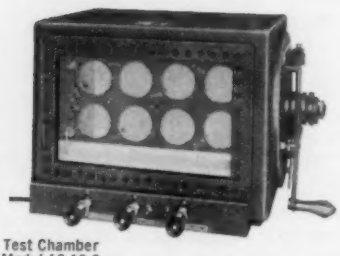
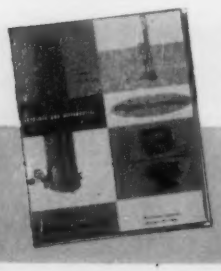
for pressure control

IDEAL PRECISION TEST CHAMBERS FOR A WIDE RANGE OF APPLICATIONS. Ideal instrument test chambers are equally suited for use in the development laboratory, production calibration or final test of the multitude of pressure operated instrument mechanisms used in the latest aircraft and missile airframes. It is not unusual to see Ideal instrument test chambers being used in the receiving inspection departments of electronic system feeder plants to check many pressure operated potentiometers and related components more rapidly and dependably than ever before possible.



Test Chamber
Model 16-13-8

IDEAL PRECISION RATE-OF-MOTION EQUIPMENT BRINGS A NEW ACHIEVEMENT IN ACCURACY. In the development and manufacture of rate-of-motion equipment for aircraft and other types of industry, Ideal takes pride in its unusual facilities which permit the production of an extensive line of equipment from rate tables to tachometer testers. In addition to production of the many standard designs, Ideal is also prepared to meet the many unusual demands for special rate-of-motion equipment. Here again, Ideal equipment assures the utmost in accuracy and reliability.



Our new pressure instrument brochure is now available... write or wire for your copy today.

Roll-Pitch-Yaw Table
Model 14-11-31

IDEAL-AEROSMITH, INC. 12909 South Cerise Avenue, Hawthorne, California

is also a great demand for the demonstrations we give for the youth organizations on Long Island. . . . Our annual audience has been conservatively estimated at 25,000 children. During the summer months we average three shows a week. The entire cost of operation is paid for by Republic.

The entire organization of the RAMS is made up of modelers like myself, and I speak for the entire group when I say that we are proud and happy to work for a company that does realize its influence on the youth of the nation.

It has been noted that there is a need for good three-view plans of jet models which could be of use to the young modeler. The RAMS are presently engaged in a project of preparing a series of brochures describing the various Republic aircraft and featuring a set of drawings for use in building a true scale model. The first of the series will be the F-84G and is scheduled for completion in the spring of next year.

I think we are all agreed that industry should do as much as it possibly can to foster youth aviation enthusiasm and, therefore, sometimes we are prone to castigate them for not always giving their all to the model program. We must remember that industry contributes to a large number of different types of programs, most of them related to fostering aviation enthusiasm.

. . . Increasingly larger sums are being spent for scholarships and other educational aids to schools all over the country in the engineering field and in other fields and many local programs are financed in part or in whole by the different aircraft companies.

I am certainly not trying to alibi for these companies, including Republic, but I wanted to make the point that our model programs, as vital as they are to the promotion of aviation, are not the only ways of advancing the "cause."

ART WALDELL, President
Republic Aviation Model Society
Farmingdale, L. I., N. Y.

Poor Airline Service

I would appreciate your printing this letter, even though it has no direct bearing on any specific recent article. . . .

It has been the experience of the writer that the service being furnished by the airlines on runs east of Chicago has deteriorated considerably. Whether this is due to the emphasis being put on the so-called "Champagne" flights, or to the increased load on most airlines, thus necessitating putting inexperienced personnel in customer service locations, is not known.

However, the fact remains that on several leading airlines the service is getting very poor and the customer service agents are becoming less polite and more inexperienced all of the time.

A recent experience with a leading airline in the New York area on a hot night with the temperatures around 90 degrees: 80 people were on a Super Constellation with a half-hour delay while the airline was loading baggage. An inquiry by a young man whose wife was not feeling well as to why the air conditioning service was not attached to this aircraft led to the reply by the flight attendant that it was "just too much trouble."

I am sure that, if the flight had not been ready for immediate departure upon this inquiry and if the agent hadn't closed the cabin door in the individual's face at the top of the ramp, there would have been further repercussions from the other passengers in the plane, inasmuch as the agent's remark could be heard the full length of the cabin.

This is just one of many typical examples of poor service by the airlines in their ever-increasing effort to not find competition. It would seem to me, as an individual with a considerable amount of flight experience during the Navy, civilian flight and many thousands of hours of commercial flight, that it is time for the CAB to remove restrictions on airlines' routes, thus enabling the airlines to pick their own routes and service these routes against whatever competition prevails.

There are many routes where more than one airline could serve, with added convenience to the customer and, at the same time, not be over-loading the routes with aircraft.

It is time the Civil Aeronautics Board pulled their heads out of the sand and evaluated the . . . flight traffic situation and permitted more carriers to service more routes, thus offering necessary competition.

There are too many monopolies on flight service between terminal points for the best interest of the customers whom the CAB is set up to represent. . . .

BARRON H. CLEMONS
Sparton Radio-Television
Jackson, Mich.

IN THE RIGHT CIRCLES

Boots engineers moved their thinking well ahead of the field in producing the new Boots lock nut gang channel. Aircraft designs demanded that these sections provide utmost rigidity for full length, straight application. Furthermore, the same design must follow sharp contours.

Boots provided more rigidity than ever before by incorporating a simple narrow ⊔ section, providing ample bucking bar room and a full 1/32" float of the nut in all directions within the channel. However, there was a question whether such a design would bend uniformly or meet minimum radius patterns.

The new Boots gang channel, "theoretically" too rigid to bend, not only bends uniformly and easily, but makes a five and one quarter inch radius circle . . . the smallest that any aircraft specifications have demanded. It is manufactured in steel, stainless steel and aluminum.

Many thousands of Boots gang channels are used in aircraft today. If your requirements demand such performance, specify Boots—and structurally you'll be in the right circles.

PATENTED. PATENTS PENDING.

BOOTS
AIRCRAFT NUT CORPORATION
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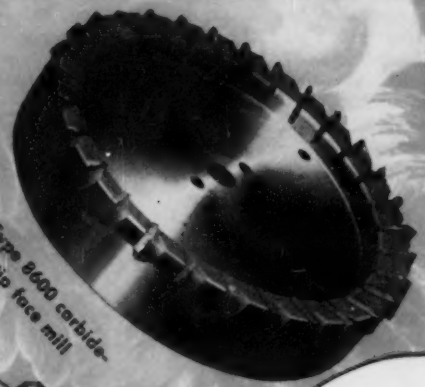
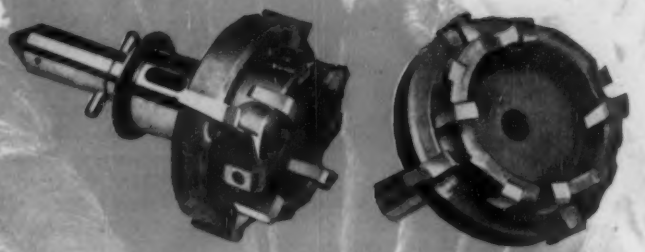
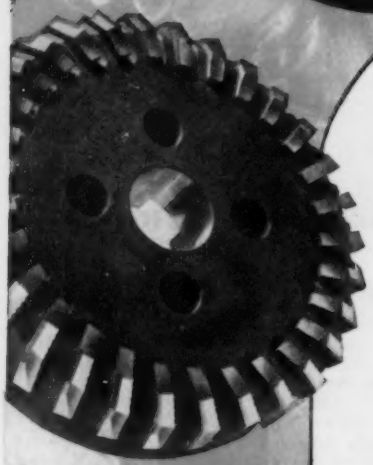


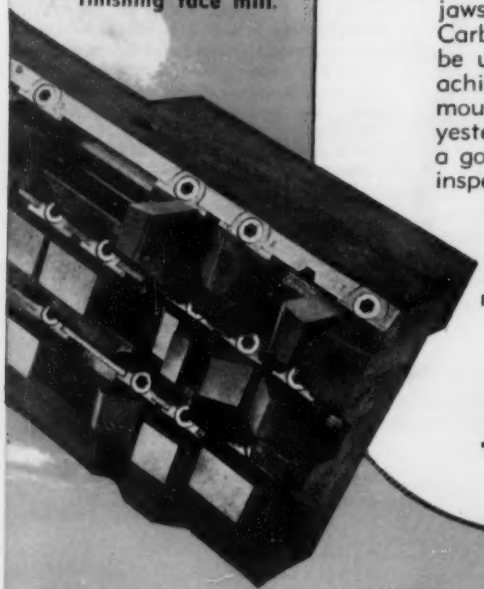
Type 8600 carbide-tip face mill



Combination hollow mill and facing head



Special carbide-tip finishing face mill.



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WHO'S WHERE

(Continued from page 9)

Dr. Louis G. Dunn, director of the Guided Missile Research Division, Ramo-Wooldridge Corp., Los Angeles. **Dr. Milton U. Clauser,** director, Aeronautics Research Laboratory.

Anthony L. Franzolino, training director for Times Aircraft Corp., appointed vice president Region 3 of the American Society of Training Directors.

Jack K. Svitzer, sales director, Allegheny Airlines. Also promoted: **Capt. Harvey M. Thompson,** director of operations; **Luke Hilliard,** director of maintenance, engineering and communications; **Elbert Cheyno,** special detail and assistant to president.

John E. Murphy, Gander district operations manager, Trans World Airlines; **Gerald Wakeham,** assistant district operations manager.

Ernest Port, project engineer, reinforced plastics division, Brunswick-Balke-Collender Co., Marion, Va.

Roy J. Herter, Detroit district manager, Cook Electric Co.

Donald Tuomi, research engineer, Edison Research Laboratory of Thomas A. Edison Inc., West Orange, N. J.

Peter Macdonald, manager of Goodyear Aircraft Corp.'s new Washington office.

Charles D. Greentree, manager-auxiliary operations, special defense projects departments General Electric Co., **Russell W. McFall,** manager-design engineering.

Carl Holst, operations manager of Lacsa Airlines.

Charles E. Reddoch, West Coast director of engineering and research for Univox Corp.

H. H. Georgens, manager-sales administration, Avien, Inc.; **John Milbouer,** manager-field sales and service.

Joseph Holland, sales manager of military products, AC Spark Plug Division of General Motors. Other changes: **Milton E. Stratton,** chief inspector; **Harry Lisiak,** superintendent of inspection.

Donald Herron, Cleveland district sales manager for Northwest Orient Airlines.

J. M. Dutton, aircraft application engineer, Vickers Inc.

C. S. Wiedman, manager of carbide products development engineering, Carboloy Department of General Electric Co.

Francis H. Barnard, controller for Northrop Aircraft, Inc.

L. L. Jones, assistant to the general manager of the aircraft products division, Bendix-Eclipse of Canada, Ltd.

John P. Fitzsimmons, facilities administrator of aircraft division, Eaton Manufacturing Co.

J. A. Cairns, sales manager, Allied Research Sales Corp.

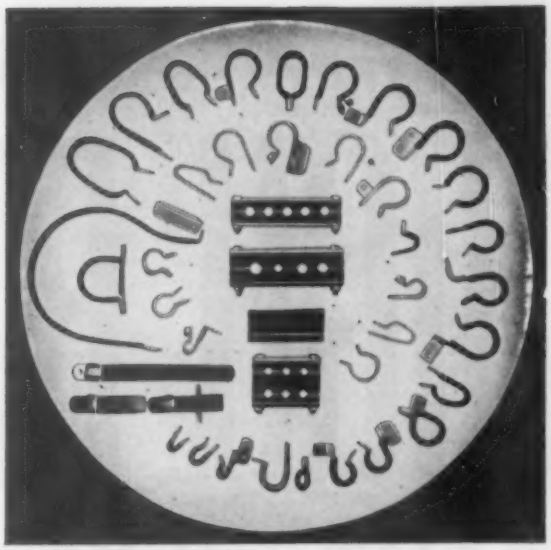
Richard Franks, manager of the West Coast engineering field office, Potter Aeronautical Co.

Walter D. Sellers, assistant sales manager, Leach Relay Division of Leach Corp.

Russell D. O'Neal, director of weapons systems planning, Bendix Aviation Corp.

A. E. Ellison, chief designer for development of P 1 interceptor fighter, English Electric Co. Ltd., Warton, Lancashire, England; **F. D. Crowe,** chief designer for the Canberra.

Cost Saving Ideas...



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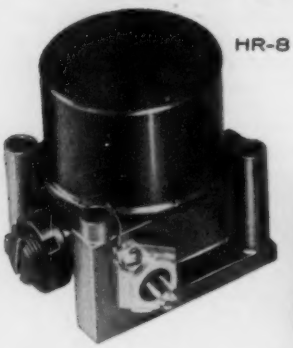
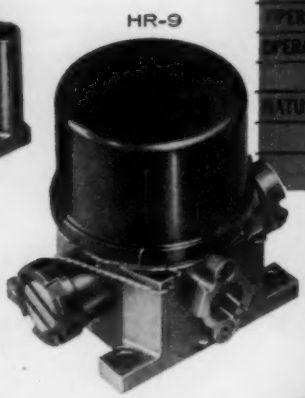


HR-8



HR-9

	HR-8	HR-9
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LEAKAGE:	.15 G.P.M. Max. (None External)	.15 G.P.M. Max. (None External)
NATURAL FREQUENCY:	250 CPS	250 CPS
DITHER:	None	None
COIL:	Concentric Double Wound	Double Wound

HR-10

HR-11

	HR-10	HR-11
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OPERATING CURRENT:	4 MA Quiescent	10 MA Quiescent
OPERATING PRESSURE:	3000 P.S.I.	3000 P.S.I.
LEAKAGE:	.15 G.P.M. Max. (None External)	.15 G.P.M. Max. (None External)
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DITHER:	None	None
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Telling the Market

General purpose d.c. power supplies are described in Bulletin 178, Opad Electric Co., 69 Murray St., New York 7, N. Y. . . . **"Mallory 1000 Technical Information Bulletin,"** data on high density metals, P. R. Mallory & Co., 3029 E. Washington St., Indianapolis 6, Ind. . . . **Rotating impact spinner-riveter hand gun,** Bulletin 86P, Lemert Engineering Co., Inc., 204 E. Jefferson St., Plymouth, Ind.

M-S-A Foille burn kit for treatment of all types of burns, Bulletin 0402-3, Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa. . . . **Indicator pyrometers** for wall or panel mounting are described in Bulletin F 6048-1, Barber-Colman Co., Wheelco Instruments Div., Rockford, Ill. . . . Application of Model 2B2B **dissolved oxygen analyzer** to steam generating plant operations, Bulletin 110-A, Arnold O. Beckman, Inc., 1020 Mission St., South Pasadena, Calif.

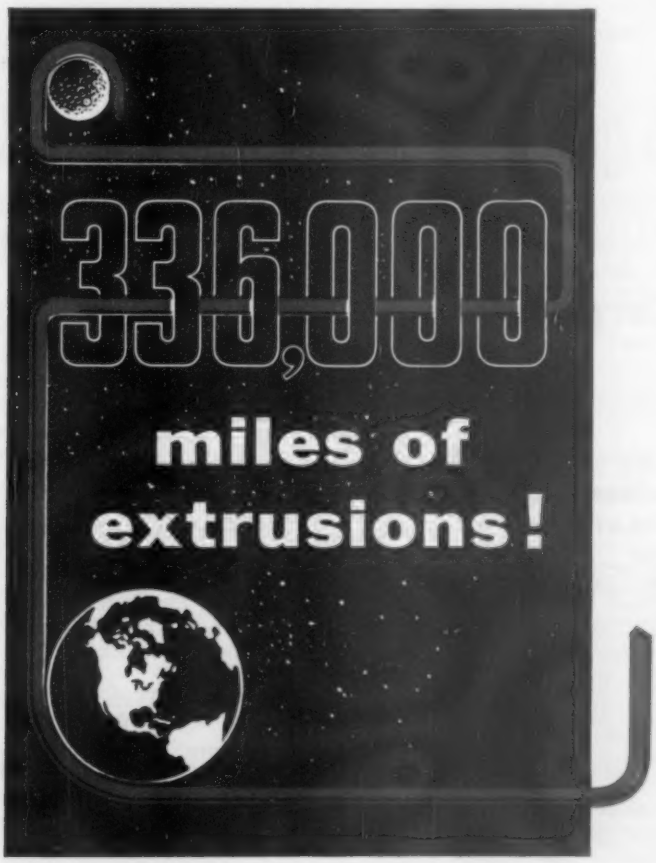
Hand and power operated rotary machines, rolls and accessories are illustrated in Bulletin 75-B, Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N. Y. . . . **Rotary files** for hard and soft metals, plastics and wood, catalog, Grobet File Co. of America, Inc., 421 Canal St., New York 13, N. Y. . . . **"AiROYmetric Pressure Generators Harness Air for Hydraulic Pressure,"** Bulletin 755, Milton Roy Co., Station J, 1300 E. Mermaid Lane, Philadelphia 18, Pa. . . . **"Tool Steels for the Non-Metallurgist,"** booklet, Crucible Steel Co. of America, P. O. Box 88, Pittsburgh 30, Pa.

Filled thermal systems for indicating, recording, controlling, transmitting, compensating and programming temperatures from −400 to +1000F, Fischer and Porter Co. Hatboro 35, Pa. . . . **Materials handling equipment** package, 25 folders, Lewis-Shepard Products Inc., Watertown, Mass. . . . **Flexidyne, dry fluid drive,** Bulletin A-640, Dodge Manufacturing Corp., Mishawaka, Ind. . . . **Fluidmotion wheel dressers,** brochure, J&S Tool Co., 87 Dorsa Ave., Livingston, N. J. . . . **Speed sensitive switches and overspeed governors** for opening and closing contacts at high speeds, Bulletin 504S, Synchro-Start Products, Inc., 8151 N. Ridgeway Ave., Skokie, Ill.

Magnetic nut running and screwdriving tools which hold nuts and screws in driving position are described in Catalog 25, Apex Machine & Tool Co., 1054 S. Patterson Blvd., Dayton 2, Ohio. . . . **Electronic three-phase direct current welding machine,** Bulletin 332-10, Public Relations, Dept. L-2, Sciaky Bros. Inc., 4915 West 67th St., Chicago, Ill. . . . **High temperature applications of arc-cast molybdenum,** booklet, Climax Molybdenum Co., 500 Fifth Ave., N. Y. 36, N. Y.

Gear and axle shaft lines information includes diameter range, diametal pitch range and maximum face width, brochure, Detroit Bevel Co., 8130 Jos. Campau, Detroit 11, Mich. . . . **Manually operated, semi and fully automatic dispensers and specialized taping machines** for pressure sensitive tapes, manual, Minnesota Mining and Manufacturing Co., Dept. P5-228, St. Paul, Minn. . . . **Silastic, silicone rubber,** performance under extreme temperatures, weathering, compression chemicals and dielectric service, brochure, Dow Corning Corp., Midland, Mich.

Epoxy resin selection chart for impregnating, insulating or potting, Furane Plastics Inc., 4516 Brazil St., Los Angeles 39, Calif. . . . **Step tapered and mechanical shaped tubing** for bushings, punches and machine parts, Data



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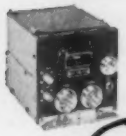

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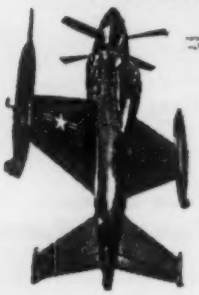

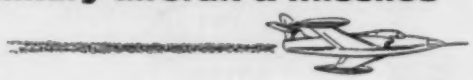

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Memorandum No. 17, Superior Tube Co., 1506 Germantown Ave., Norristown, Pa.

A Guide to Specialty Steels, booklet, Carpenter Steel Co., 328 W. Bern St., Reading, Pa. . . . **Selected Scientific and Engineering Tables and Data,** booklet, United States Testing Co., Inc., 1415 Park Ave., Hoboken, N. J. . . . Engineering data on **metallic standard and self-energized O-rings,** brochure, United Metallic O-Ring Dept., Box 1035, Dayton 1, Ohio. . . . Operating advantages of **Hyster Monomast lift truck** are illustrated in Catalog Form No. 1402, Hyster Co., 2902 N. E. Clackamas St., Portland, Ore., or 1003 Myers St., Danville, Ill.

Products for Plastics Reinforcement, booklet, Owens-Corning Fiberglas Corp., Textile Products Div., 598 Madison Ave., New York 22, N. Y. . . . Load capacities, design standards and considerations of **Beaver ball screws,** brochure, Beaver Precision Products Inc., 651 N. Rochester Rd., Clawson, Mich. . . . **Color Slide Sequences as Aids in Business and Education,** Pamphlet No. S-6, Sales Service Div., Eastman Kodak Co., Rochester 4, N. Y.

Publication Received

• **Project Skyfire, Cloud and Lightning Observation Handbook**—by Paul B. MacCready, Jr., Vincent J. Schaefer, John H. Dieterich, J. S. Barrows—Available from Munitalp Foundation, Inc., 630 Fifth Ave., New York 20, N. Y. 47 pp. Cloud-observation techniques.

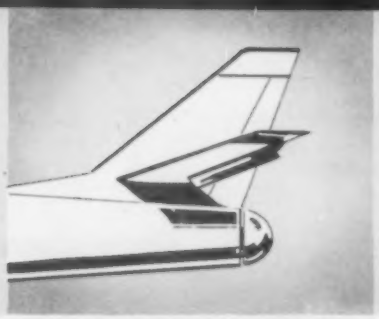
• **Machining Kaiser Aluminum With Automatic Screw Machines**—Pub. by Kaiser Aluminum & Chemical Sales, Inc.—Available upon request to Technical Editor, Kaiser Aluminum & Chemical Sales, Inc., 228 North LaSalle St., Chicago 1, Ill. 52 pp. Technical data and tooling information.

• **Proceedings of the Symposium on Printed Circuits**—Pub. by Engineering Publishers, GPO Box 1151, New York 1, N. Y. $5.00. 122 pp. Full versions of the technical papers presented at the 1955 Symposium on Printed Circuits sponsored by the Engineering Departmentment of Radio-Electronics-Television Manufacturers Assn. with the participation of the Professional Group on Production Techniques of the Institute of Radio Engineers.

• **Brazing Manual**—Prepared by American Welding Society—Pub. by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. $4.75. 193 pp. Handbook of brazing for metal-producing or metal-using industries.

MISSILE SYSTEMS

AERIAL CAMERAS



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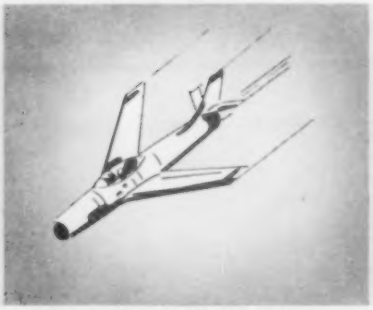

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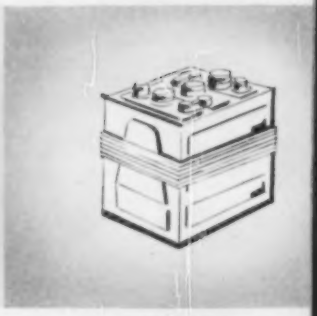

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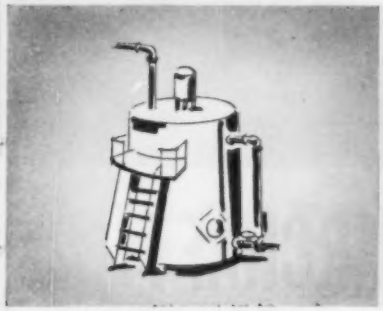

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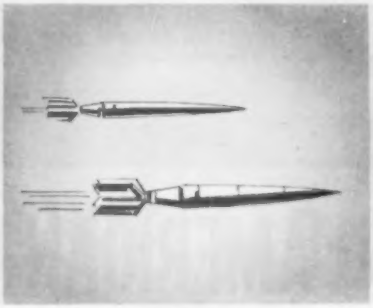

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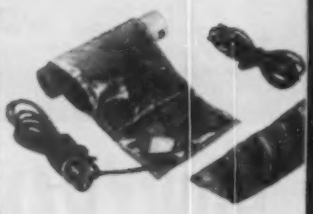

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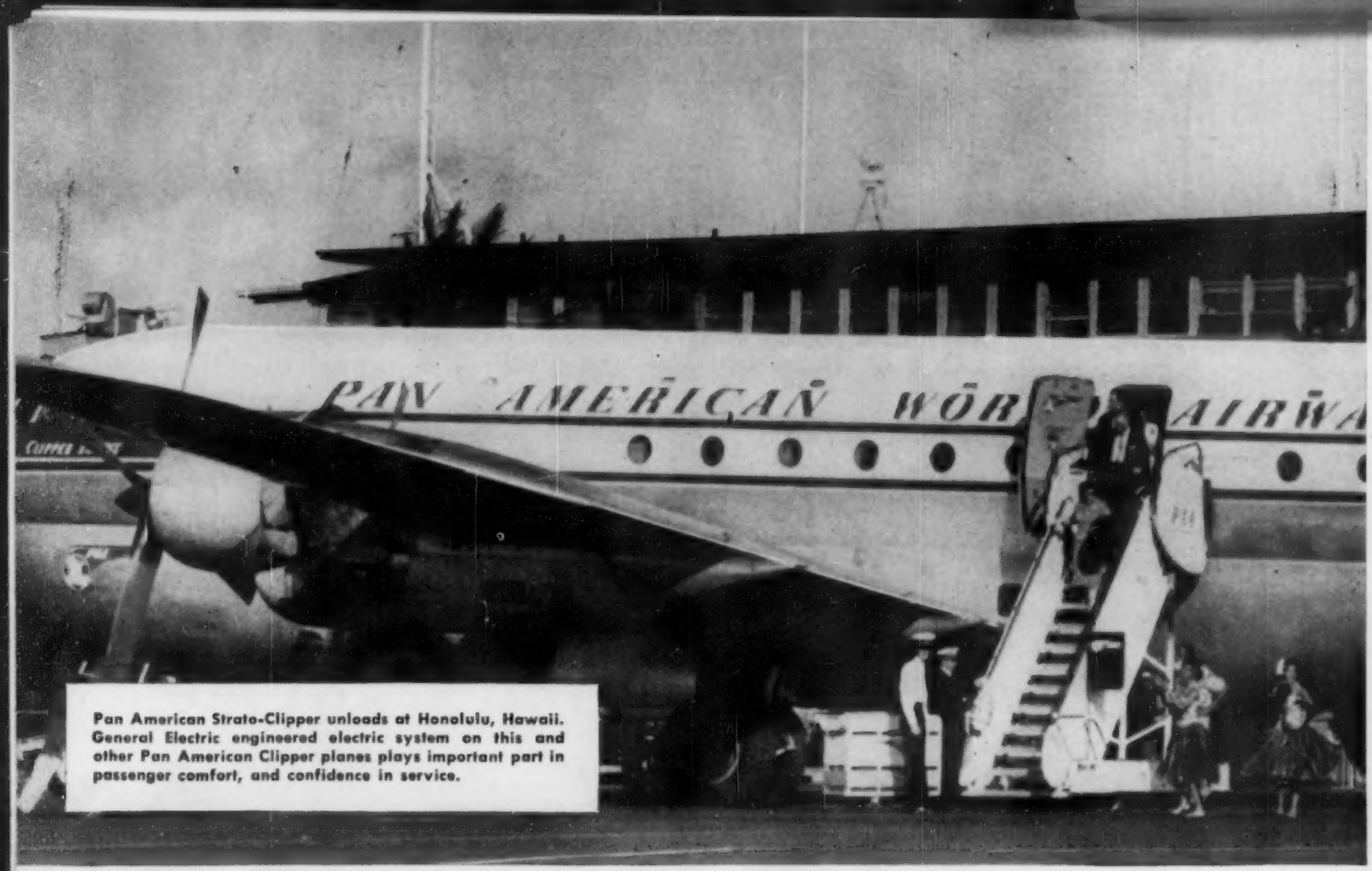


Pan American Strato-Clipper unloads at Honolulu, Hawaii. General Electric engineered electric system on this and other Pan American Clipper planes plays important part in passenger comfort, and confidence in service.

HOW PAN AMERICAN IMPROVES AIRCRAFT

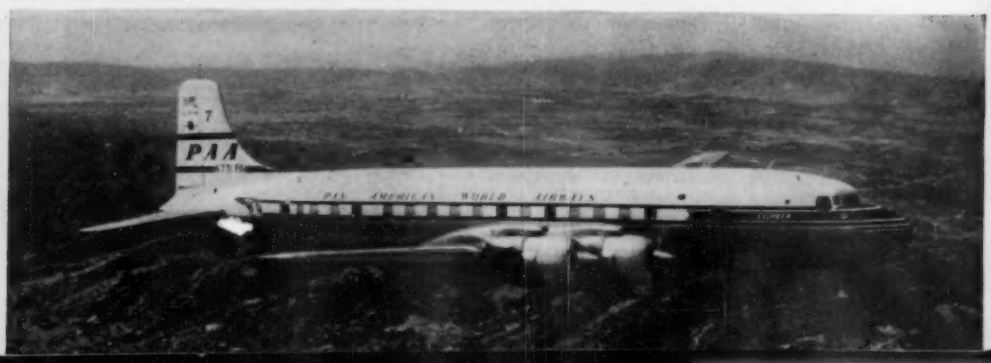
Located in nose of Strato-Clipper, G-E protective panel helps assure electric system reliability.

Arrangement of G-E circuit breakers shows high accessibility—an important part of Pan American's program for easier maintenance of electric systems.

At Pan American's service shops, G-E field engineers assist in helping to improve reliability of electric components.

Long life of G-E aircraft generators has been attained through improved brush riggings and bearings.

The new Douglas Super 7 Clipper makes maiden voyage for Pan American's 50,000th trans-Atlantic crossing, representing 150 million miles of flight. Airline's success with G-E electric systems led to Pan American specifying G.E. for new fleet of "Super-7's."



ELECTRIC SYSTEM RELIABILITY

G-E design engineering combined with first class field service help Pan American increase life of power generating systems.

Dependability of Pan American World Airways' aircraft generating systems is the result of a continuous co-operative effort between General Electric and the airline to increase the life and reliable operation of the G-E components which help make up the system.

This reliability is essential. Pan American's flights travel over jungle, desert, ocean, and rugged mountain terrain in all parts of the world. Any trouble encountered in the plane's electric system could mean time-consuming delays at remote air fields. These could be costly to the airline *and* passengers.

G.E. develops protective system

To meet such problems before they occurred, Pan American called in General Electric to work closely with them and the airframe manufacturers. Conferences were held, and G-E application engineers designed and demonstrated a generator protective system which fulfilled all the requirements. So successful was this system that adaptations were installed on Pan American's new DC-6B's and DC-7B's aircraft.

At the same time these engineering strides were being made, G.E. carried on a continuous field service to assist Pan American's overhaul shops in improving the component performance of the systems. This field service assistance with the airline is still operating today. The result—the G-E electric system has given Pan American the increased safety protection its service demands, as well as better operating performance. That's why they are specifying G-E generator systems on new aircraft purchases.

Service available to you

G-E application and field service engineers can help solve your electric system requirements regardless of where you are located. For further information, contact your G-E Aircraft Specialist through your nearest G-E Apparatus Sales representative today. General Electric Company, Schenectady 5, N. Y. 210-96

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BOEING B-47, 6-JET BOMBER, at the Georgia Division, Lockheed Aircraft Corp., Marietta, Georgia, serviced by G-E Frequency Changer Package that supplies ground power for testing of electrical control and equipment for radar, radio, and electrical systems.

LOCKHEED AIRCRAFT CORPORATION REPORTS . . .

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V. O. CAMPBELL, ELECTRONIC STAFF SPECIALIST AT LOCKHEED says, "We have found in G-E Frequency Changers the high degree of accuracy and complete reliability necessary in the assembly and testing of the B-47s which we are building for the Strategic Air Command of the U.S. Air Force."

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AMERICA'S HOTTEST JETS

G-E TOTALLY ENCLOSED MOTOR FOR GUIDED-MISSILE WARHEAD FUZES, rated .0024 hp, 4500 rpm, 24 volts d-c for intermittent duty is discussed by (l to r) Dr. W. W. Eaton, Industrial Consultant, Dr. C. A. Crowley, Director of Engineering and Development Division, Given Manufacturing Company, and E. Finkle, Given's Chief Project Engineer, Engineering and Development Division.

G.E. adapts motor for missile warhead fuzes, helps Given Company meet deadline, cut costs

"When our Company was selected by the Picatinny Arsenal for pilot production of fuzes for guided-missile warheads," says Dr. C. A. Crowley (center), Director of Engineering and Development, Given Manufacturing Company, "we were confronted with a design that called for a specially built motor to be used for the fuze gear train. Because of previous satisfaction, our first step was to consult General Electric.

"G-E engineers, working in co-operation with our own engineers, were successful in redesigning an existing G-E armament motor to our exact needs. This action not only helped us cut costs, but put us in production on schedule. We're sold on service like this," concludes Dr. Crowley.

As a component of these guided-missile warhead fuzes, the G-E motor is exposed to extremes of temperature from −65 to +160F, and must stand severe vibrations and high humidity. As a part of G.E.'s development work, these conditions were simulated by G-E testing facilities, and the motor passed all tests.

TO SERVE YOU, General Electric offers engineering experience like that provided the Given Engineering and Development Division—experience gained through years of helping solve hundreds of difficult aircraft and armament motor problems. Contact your local G-E Apparatus Sales Office early in your planning. Or write giving details to Section 704-55, General Electric Company, Schenectady 5, N. Y.

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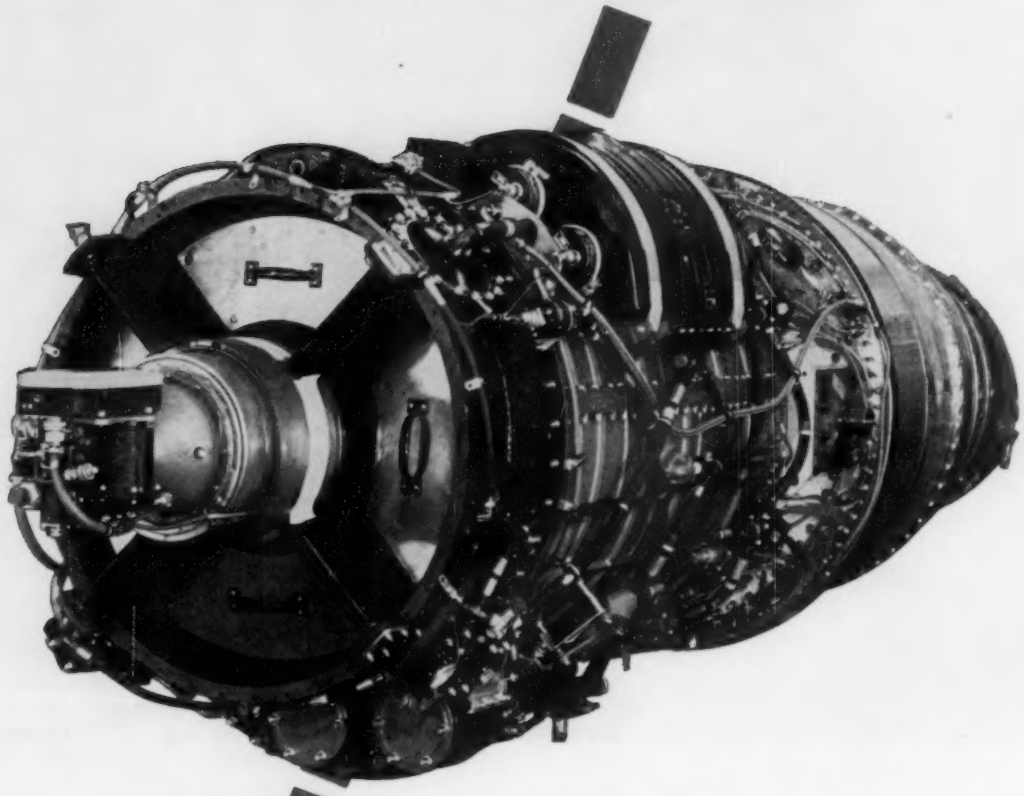

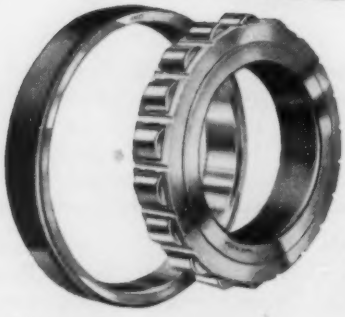

When astonished test pilots put the sensational new Lockheed F-104 through its paces, they promptly nicknamed it the *"Gee Whizzer"*—and no wonder! One of the newest and fastest American interceptors, powered by a J-65 jet engine with a thrust equalling *thirteen thousand horsepower,* it has a reported speed of *1500 mph!*

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CAB Report on Northeast Airlines' DC-3 Accident

Faulty ILS Descent Caused Crash

THE ACCIDENT

Northeast Airlines' Flight 792, a DC-3, N 17891, crashed during an instrument descent to the Berlin, N. H., airport on Nov. 30, 1954, about 1115.[1]

The first officer and a company flight superintendent, who was on the cockpit jump seat, were killed. The captain was seriously injured; the stewardess and two of the three passengers were uninjured; the third passenger was later treated for injury.

HISTORY OF THE FLIGHT

Flight 792 originated at Boston, Mass., for Berlin, N. H., with stops at Concord and Laconia, N. H.

The crew consisted of Capt. W. P. Carey, First Officer George D. McCormick, Stewardess Mary McEttrick, and Flight Superintendent John C. McNulty.

Departure from Boston was at 0930, approximately on schedule, with a company clearance to Laconia under Visual Flight Rules. The first two segments of the flight, Boston-Concord and Concord-Laconia, were routine.

Departure from Laconia was on schedule at 1039. The aircraft carried fuel for about four hours, its gross weight was considerably under the maximum allowable, and its center of gravity was located within prescribed limits. Scheduled arrival at Berlin was 1112.

A minute or so after takeoff the flight requested an IFR clearance for the 73-mile flight, which was at once approved by the company dispatcher at Boston, and issued by the CAA's Air Route Traffic Control Center. "Boston ATC clears Northeast Flight 792 for an approach to the Berlin Airport via Blue 63 to cruise 8,000 feet."

At 1103 the flight called the company station at the Berlin Airport and asked for local weather. The station agent immediately gave the 1045 observation: Estimated 3,000 feet overcast; visibility 2½ miles; light snow showers. The flight acknowledged but did not give its altitude and position.

The agent then made a special weather observation at 1110 and transmitted the following information to the flight: 2,300 scattered, 3,000 overcast; visibility 2½ miles; light snow showers; wind northwest 10; snow showers to the north. (This was close to the Berlin minimums of 2,300-foot ceiling and 2 miles visibility.)

The flight's acknowledgment of this transmission was logged at 1114; however, the actual time may have been as much as two minutes earlier as the agent was alone and busy. There was no further contact. No position report was received for North Conway, a company-required reporting point about midway between Laconia and Berlin.

At 1125 the company's Boston station asked by teletype regarding the flight. Accordingly, the Berlin operator called the flight at 1128 but received no reply. At 1130 he sent a special weather report and suggested that the flight return to Laconia.

Again there was no reply. (The accident had already occurred.)

This special weather was: Ceiling estimated 1,500 feet broken, 3,000 feet overcast; visibility 2 miles; light snow; wind northwest 10 (below Berlin minimums).

INVESTIGATION

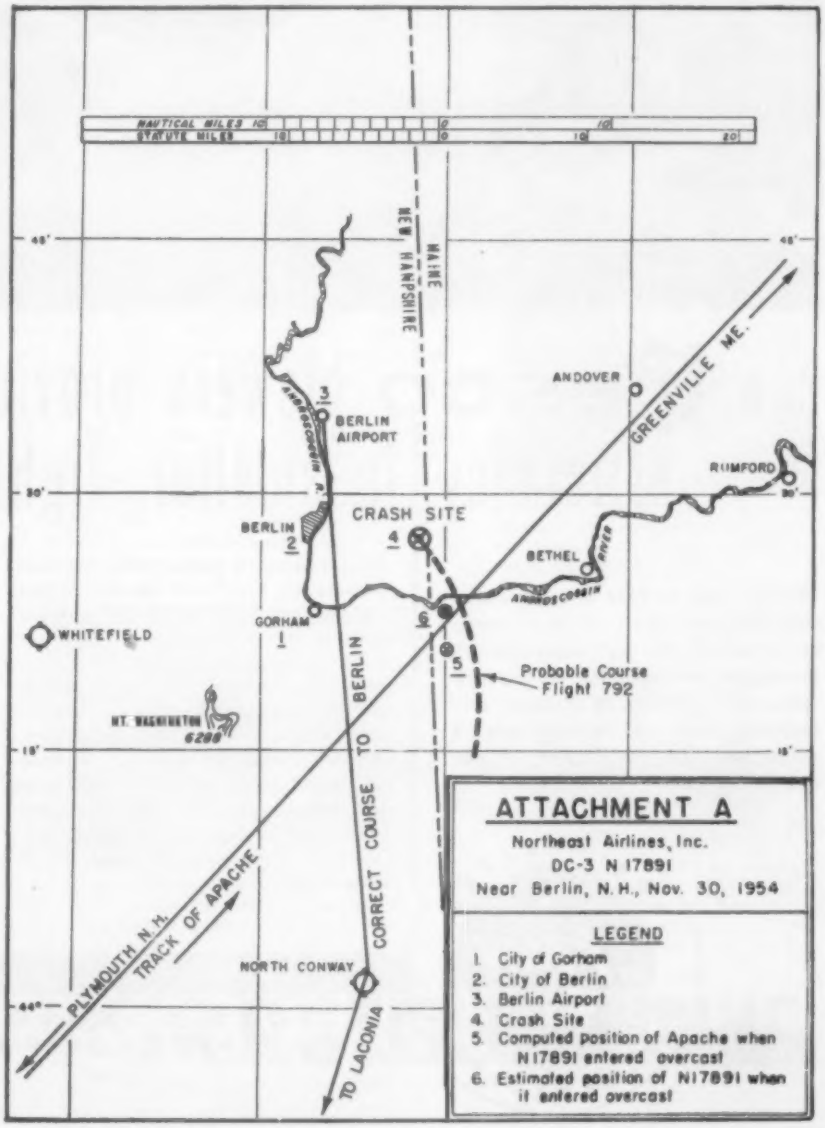
Search activities were started when it was evident that the aircraft was down. Continuing low ceiling and snow squalls hampered search.

About 0755 the following morning, Dec. 1, a message from the aircraft was heard by the company's Berlin station. It was not clearly or completely understood but indicated that the flight was down approximately five miles northeast of the field on a hill. The station agent immediately acknowledged the message (which was not received by the aircraft) and quickly notified company headquarters.

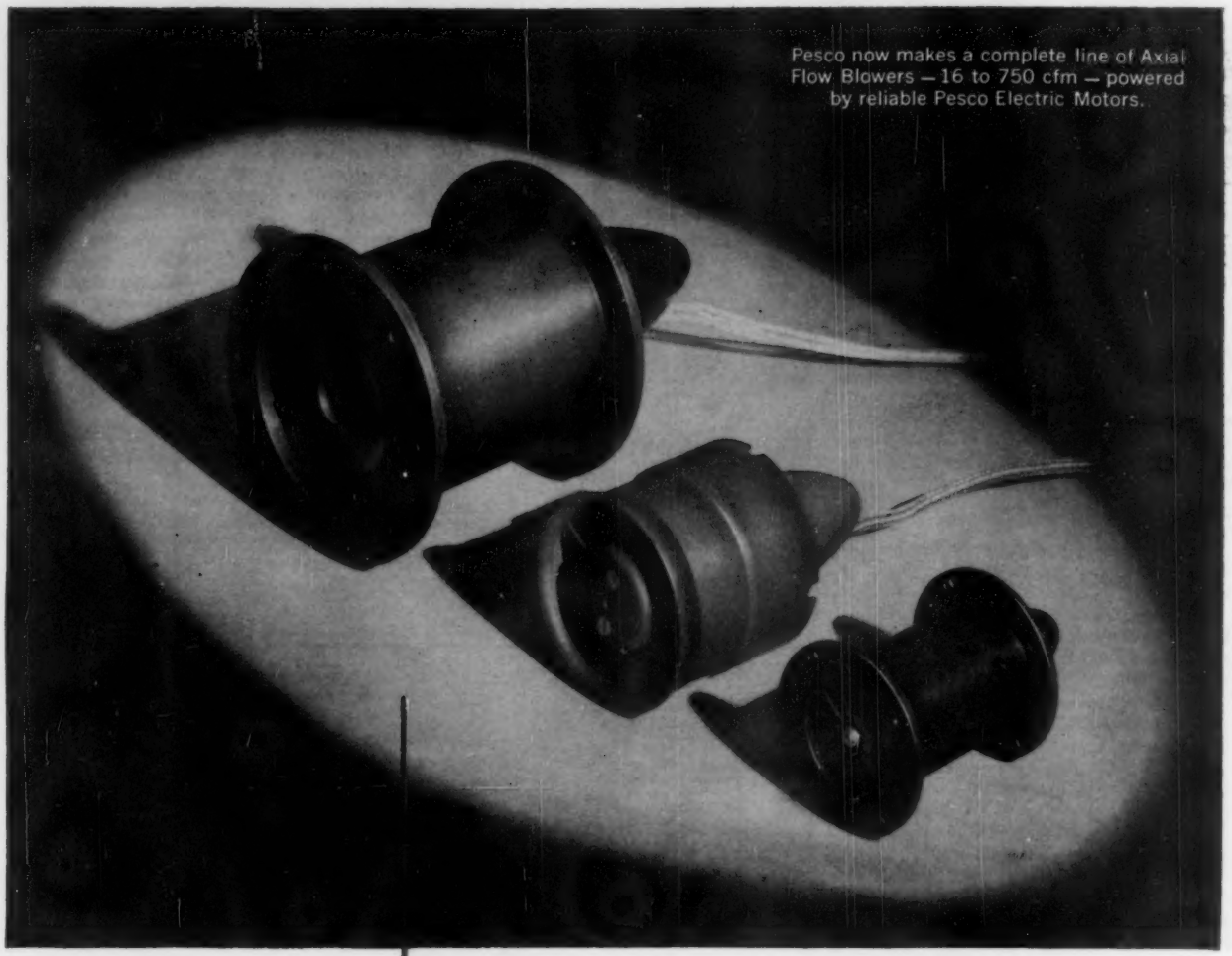
Search by ground parties and from the air was as extensive as the prevailing bad weather would allow. Late in the afternoon of the same day ceiling and visibility improved and remained better through the night. Air search of the higher terrain was possible the next morning, Dec. 2, when a Northeast Airlines DC-3 sighted and identified the wreckage on the southern slope of Mt. Success, 13 miles southeast of the Berlin airport.

An Air Force helicopter had been standing by at nearby Grenier AFB, Manchester, N. H. It was flown to the crash site and a doctor was lowered. Survivors and the bodies of the two crew members were then flown to the Berlin Airport, one at a time.

In the meantime, Board investigators had also been airlifted to the scene allowing the immediate start of an on-the-spot investiga-



[1] All times herein are Eastern Standard and are based on the 24-hour clock.



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tion. The bare hilltop about one-fourth mile away afforded a convenient site for many subsequent flights.

Survivors testified that the seat belt sign came on several minutes before impact and all occupants, including the crew, had their belts fastened. No significant injuries were sustained by the stewardess and the three passengers in the cabin. However, all three flight crew members were thrown forward, and McCormick and McNulty received fatal injuries. Capt. Carey, despite severe injury, supervised survival activities.

A fire started under the left engine mount as the aircraft came to rest. It was quickly put out with snow and a cabin fire extinguisher.

Survival was the chief concern. Outside temperature was far below freezing and cabin temperature was dropping fast. Occupants huddled closely to conserve body heat, wrapping themselves with blankets, cabin insulation, upholstery, curtains, seat cushions, soundproofing material, and clothing from baggage.

The following morning Capt. Carey managed to send a series of radio messages after experimenting with different frequencies and improvised circuits. Only one message, previously mentioned, was heard. He also marked his assumed position, some five miles northeast of the airport, on an aeronautical chart. It was decided not to try walking out because of the lack of proper footgear and clothing, and also because the captain, the only one with any knowledge of the local geography, was fast losing vitality.

Late that day the weather improved. Capt. Carey could see the countryside and realized that his original position estimate was in error and that the crash site was southeast of the airport in the vicinity of Mt. Success. But the batteries were then depleted and the radio could not be used. Falling temperature made survival even more critical that evening and night. Early the second morning, the Northeast Airlines' search aircraft spotted the wreckage.

The aircraft had struck the wooded and deeply snow-covered southern slope of the mountain, approximately 100 feet below the crest, at an elevation of 3,440 feet. Snow was falling at the time.

Impact occurred while the aircraft was on a heading of approximately 350 degrees and nearly level both laterally and longitudinally. Airspeed was about 140 knots into a wind that was probably of 40-50 knots making the groundspeed 100 knots or less at impact. Ahead, the ground sloped up at an angle of some 10 degrees.

The aircraft crashed directly ahead through timber for only about 100 feet. No timepieces were impact stopped nor was the precise time of the crash noted.

Trees tore away the left wing tip, the left engine, and a large part of the right wing. The fuselage was bent to the right at the wing by some 12 degrees so that the forward portion was at a direction of 2 degrees, with the rear part at 350 degrees.

The cockpit was generally smashed and telescoped backward and upward but there was relatively little damage to the cabin

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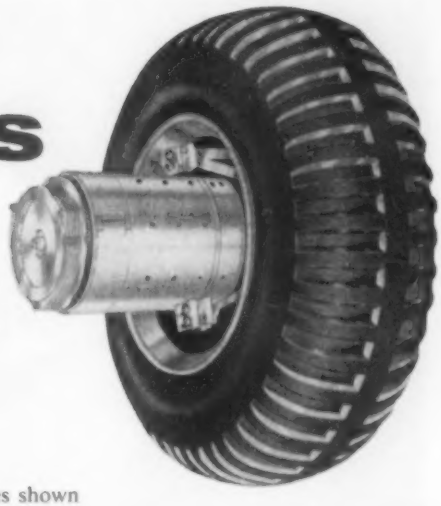
BIG WHEELS and... little switches



Consider the LeTourneau machines shown here. In each case a team of *big electric wheels* does the instant bidding of *little electric switches* . . . a single operator in the cab of any one of these giants moves a simple control and the machine instantly responds.

Each of the big wheels drives, brakes, and can be steered — for each is a LeTourneau Electric Wheel, a new type of power package consisting of a LeTourneau Electric Motor and Gear Reduction within the rim of the wheel. These wheels float on huge, extra-wide base tires, which provide ground contact area up to 4 feet wide at each wheel for greater traction and flotation than ever before obtainable, making operation possible in deep mud, powdery snow, or loose beach sand.

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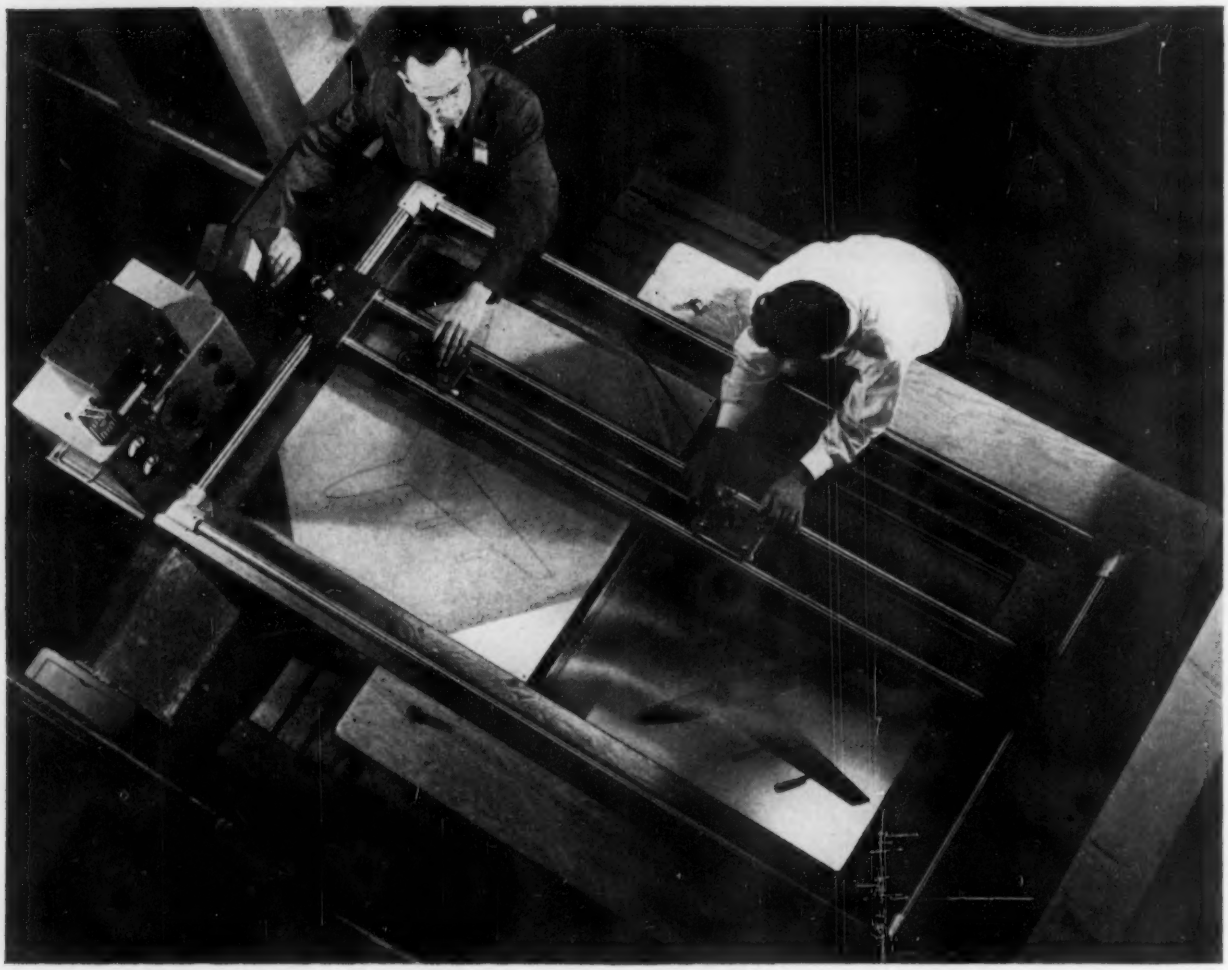

Boeing engineers are kept free for creative assignments

Thanks to draftsmen and engineering aides, Boeing engineers are free to handle stimulating projects like this: determining antenna properties in an electrolytic tank. Results taken with the three-dimensional plotter will influence the configuration of "years-ahead" Boeing airplanes and guided missiles now in the design stage.

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This electrolytic tank is one example of the superb equipment at Boeing engineers' disposal. Other facilities include the world's most versatile privately owned wind tunnel, a new tunnel under construction, capable of velocities up to Mach 4, the latest electronic computers, and splendidly equipped laboratory and test equipment in the new multi-million-dollar Flight Test Center.

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proper, allowing survival of all cabin occupants.

The landing gear had been extended and locked before impact. Propeller pitch settings were left blades 18 degrees, right blades 25 degrees.

Pertinent control and instrument readings were checked. Both altimeters were set to 29.66 inches, the latest altimeter setting given the flight. The directional gyro read 356 degrees. The No. 1 range receiver was tuned to 383 kc. and its volume was set at approximately 5%. The Omni (VOR) receiver was set at 117.5 mc. and its volume was 95%.

The No. 2 range receiver ADF unit was tuned to 280 kc. and its volume was set at approximately 5%. The needle of the ADF indicator had broken so that it could swing freely. This No. 2 receiver (the one being used for ADF) was recovered from the aircraft and very thoroughly tested. No irregularity was found in the unit or any of its components. The 280 kc. setting was practically on the frequency of the Berlin beacon (281 kc.). This small difference would have little or no effect.

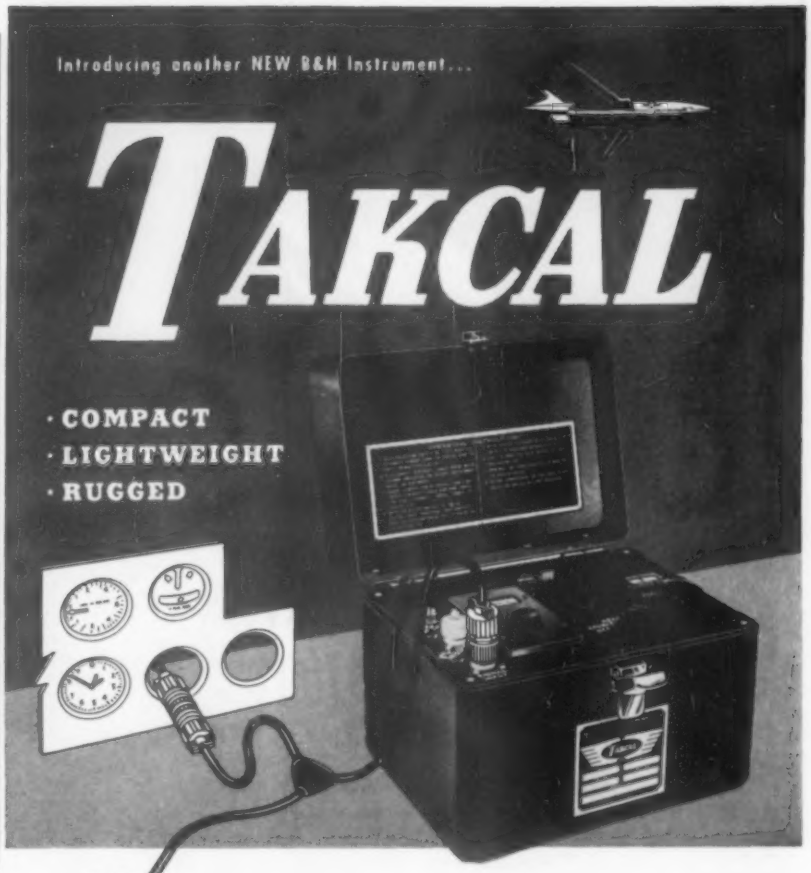
However, the loop and the loop housing, mounted on the underside of the fuselage, were knocked off. The loop was not recovered until May 13. A detailed study of damage to its main drive gear indicated that the most probable loop direction at the time of impact was 344 degrees. This would correspond, because of quadrantal compensation, to a cockpit indication of 335 degrees.

The H facility (a nondirectional continuous low power radio beacon) on the Berlin Airport was ground checked on the day of the accident, both before (routine) and after the crash, and found to be operating normally. It was flight checked three days later when weather allowed, and also found to be operating normally. This beacon is the only radio navigational facility at the Berlin Airport.

Capt. Carey stated, in substance, that he climbed to 8,000 feet altitude, as called for in his clearance, while en route to Berlin. At this altitude he was above broken clouds until he was approximately 18 miles south of the airport. Beyond that point he was above a solid overcast. He had been using his ADF in obtaining a tail bearing on the Conway beacon and when about half-way to the city of Berlin, tuned it to the frequency (281) of the Berlin Airport beacon. The needle swung ahead and he followed it.

He testified that he did not stay at 8,000 feet (his assigned cruising altitude and also the minimum en route altitude for that segment of the flight) until he overheaded the Berlin beacon as required in the company's operations manual and as shown on his Jeppeson Berlin Plate. Instead, he started descent before reaching it.

The captain further testified, also in substance, that he entered the overcast at an altitude of about 6,000 feet, and thought that he passed over the beacon, as shown by the reversal of his ADF needle, at approximately 5,500 feet while in clouds; also, that he immediately started the prescribed letdown procedure, taking up a



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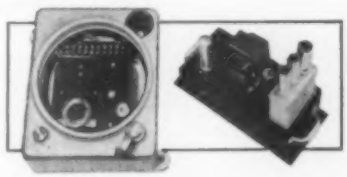

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heading of 351 degrees and then turning to 25 degrees, rather than 36 degrees as specified, to allow for a northwest wind.

While reversing his course in the procedure turn he struck the ground without seeing it. He experienced sharp turbulence and one or more severe downdrafts while in the overcast, one just before impact. Passengers corroborated the rough air.

For many miles surrounding the crash site the region is sparsely inhabited and extremely rugged. But a number of people came forward with statements of seeing and/or hearing an airplane in the area about the time of the crash. Search planes were in the air soon after the aircraft was known to be down and these, in all probability, were the aircraft seen and heard.

Two men flying a privately owned Piper Apache saw Northeast Flight 792 shortly before it crashed. They were en route from Plymouth, N. H., to Greenville, Me. This course is about 50 degrees and passes about 11 miles to the southeast of Berlin, N. H.

Both men were pilots and one was primarily concerned with navigation, which he was studying. Their radio compass was tuned to the commercial broadcast station at Berlin. Their cruising altitude was 7,000 feet where they were in clear weather with a quite solid overcast about 1,000 feet below them.

In the distance, to their right, they saw another airplane and as they came approximately abeam of the city of Berlin, 11 miles to their left, the other airplane was close enough to identify (by its blue and white tail marking) as a Northeast DC-3.

They watched it start down from their own altitude of about 7,000 feet and descend, with wheels down, into the overcast at 6,000 feet headed in a northwesterly direction. As it did so the Apache pilot retuned his radio compass to the beacon at the Berlin Airport. The needle swung nearly abeam to the left pointing at the Berlin Airport and also at the DC-3, just then entering the overcast about two miles from the Apache.

The Apache pilots landed at their destination and learned that Northeast Flight 792 was missing. Believing it was the DC-3 they had seen, they immediately computed their position and the approximate time when they saw it enter the overcast. The position was 18 statute miles southeast of the Berlin Airport; the time was 1105. (See attachment, p. 111.)

ANALYSIS

Capt. Carey attributed the accident to a premature reversal of the ADF needle. But, as already stated, a detailed study of the ADF receiver disclosed no malfunctioning or irregularity in any of its components that could cause a premature reversal. It is only fair to state, however, that there have been a few—extremely rare—cases of unexplained premature ADF reversals.

Capt. Carey testified that he interpreted his clearance ". . . to cruise 8,000 feet," as meaning that he could descend from 8,000 feet before overheading the Berlin beacon and even go as low as 5,000 feet before starting his 171-degree approach track toward the airport.

However, the operations specifications

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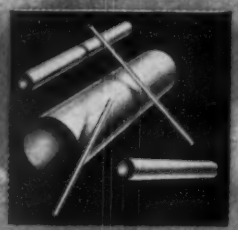

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approved by the Administrator for the Berlin, N. H., airport and the company's manual for guidance of pilots, called for maintaining 8,000 feet until overheading the Berlin beacon.

It is difficult to understand why Capt. Carey, in view of his long experience including 15 scheduled landings at Berlin, interpreted his clearance to give him authority to descend when he did, contrary to company requirements.

According to the Flight Information Manual, the term "cruise" rather than "maintain" is used in air traffic clearances to signify that descent may be commenced at the pilot's discretion. Its use is normally confined to relatively short flights under circumstances permitting the issuance of a clearance authorizing an aircraft to proceed to and land at the destination without further clearance.

However, the Flight Information Manual also points out that "aircraft operated in accordance with IFR must be flown at not less than the minimum altitude established by the Administrator . . . for that portion of the route over which the operation was conducted."

The requirements contained in this type of clearance are outlined in Civil Air Regulations 40.409.[3]

The type of clearance issued to this flight was an IFR clearance to cruise at 8,000 feet. An IFR clearance which does not specify "Over-the-top" requires that an airplane shall not descend below the pertinent minimum altitudes for the initial approach until arrival over the facility has been definitely established. In other words, CAR Part 40.409 applied to the subject clearance.

In this case the minimum en route altitude and the initial approach altitude were the same, 8,000 feet. Therefore the flight had no authority to descend below 8,000 feet prior to arrival over the H facility.

Had the flight been cleared to cruise at a higher altitude, say 10,000 feet, it would have been permissible to let down from 10,000 feet to overhead the station at 8,000 feet on the initial approach. A clearance to maintain 10,000 feet would require that the flight overhead the station at 10,000 feet.

Capt. Carey's premature letdown from his 8,000-foot cruising altitude was the dominant factor leading to the accident.

It must be borne in mind that the crash

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[3] "40.409 Altitude maintenance on initial approach:

(a) "When making an initial approach to a radio navigational facility under IFR (excluding over-the-top conducted in accordance with the provisions of 40.408 (c), an airplane shall not descend below the pertinent minimum altitude for initial approach specified by the Administrator for such facility until arrival over the radio facility has been definitely established;

"(b) When making an initial approach on a flight being conducted in accordance with the provisions of 40.408 (c), a pilot shall not commence an instrument approach until arrival over the radio facility has definitely been established. In executing an instrument approach procedure under such circumstances, the airplane shall not be flown at an altitude lower than 1,000 feet above the top of the lower cloud or the minimum altitude specified by the Administrator for that portion of the instrument approach procedure being flown, whichever is the lower."

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site was nearly in line with the runway of intended landing, that the direction of impact was extremely close to the direction of the airport, that the point of impact was only some 100 feet below the top of a hill which was the highest land between aircraft and airport, only 13 miles ahead, and that the last Berlin weather given the flight was close to Berlin minimums and becoming worse.

The most probable position of the ADF indicator, 335 degrees, as mentioned under the section headed "Investigation," is 25 degrees to the left of the aircraft's actual heading at time of impact. Because of many intangibles and unknowns entering into a determination of the probable direction, it is believed that the indicator may well have read zero (directly ahead) or close to it at time of initial impact, thus lending credence to the probability of a straight-in ADF approach.

In reconstructing this short flight from Laconia (only 73 statute miles) it is evident that Capt. Carey started his descent too early and was attempting a straight-in approach to the runway, in order to get beneath the overcast while short of the airport and ahead of the weather.

His position, about nine miles to the right of course, when starting down through the overcast is believed not to be accidental due to wind drift, but planned to facilitate a straight-in approach.

Since Capt. Carey testified that he had visual reference to known objects on the ground up until a very few minutes before entering the overcast, it can only be concluded that he knew his ground position when starting his letdown. Moreover, testimony of the Apache pilots gives a clear time-position picture of the start of this letdown.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The aircraft, the crew, and the carrier were currently certificated.
2. The aircraft was properly loaded in respect to gross weight and location of its center of gravity.
3. All radio facilities, both ground and airborne, were functioning normally.
4. The flight was on an instrument clearance.
5. The 1114 company weather message for Berlin reported marginal weather conditions; this was acknowledged.
6. The pilot started his descent not in accord with the approved instrument approach procedure for the Berlin, New Hampshire, airport.
7. In so doing he struck a hill while letting down directly toward the airport.

PROBABLE CAUSE

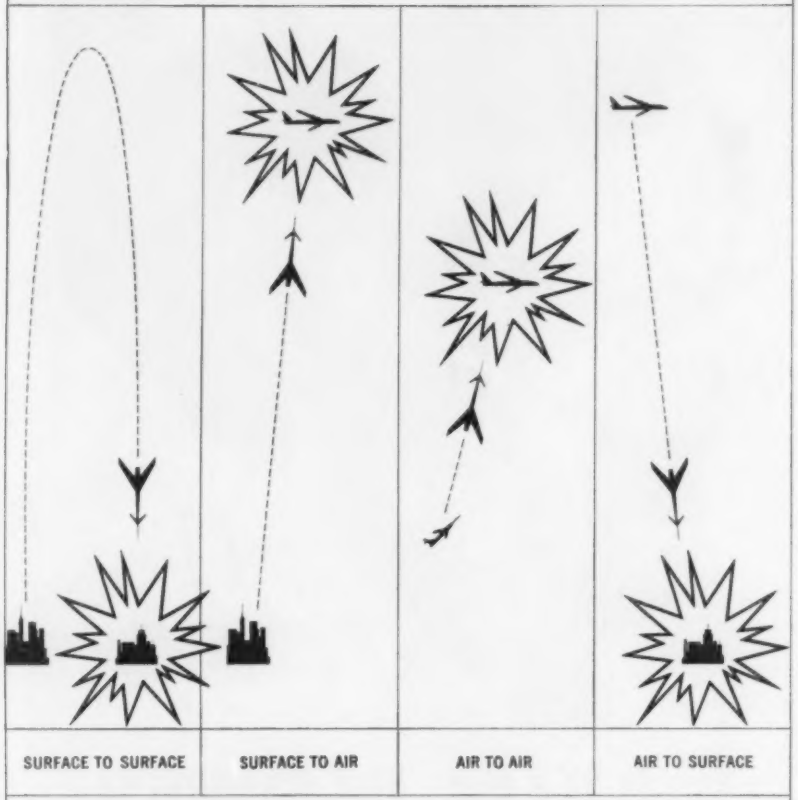
The Board determines that the probable cause of this accident was a premature and unauthorized instrument descent to an altitude that did not permit terrain clearance.

By the Civil Aeronautics Board:

Joseph P. Adams
Josh Lee
Chan Gurney
Harmar D. Denny

(Ross Rizley, Chairman, did not participate in the adoption of this report.)

GUIDED MISSILES



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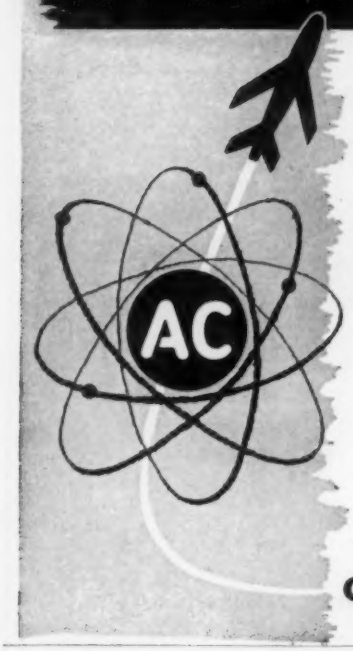

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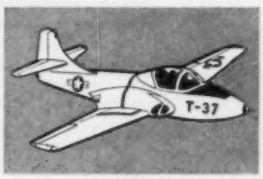

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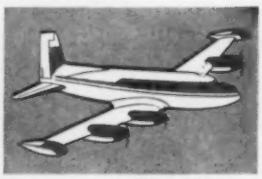
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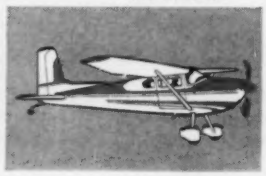
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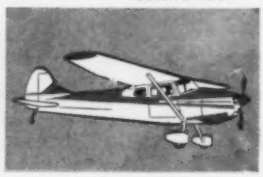
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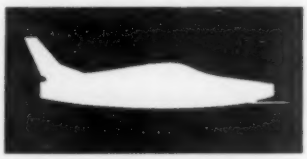

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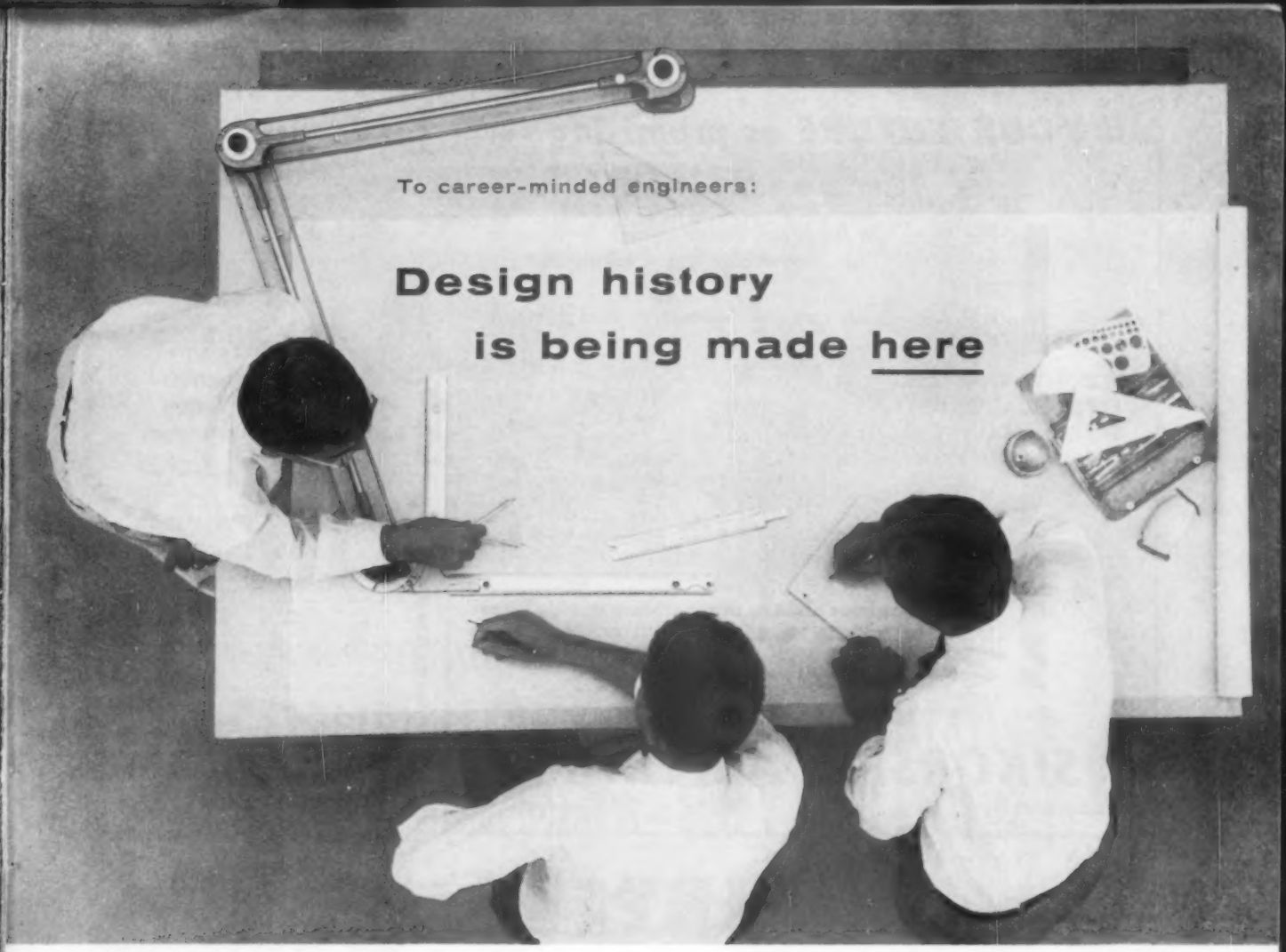

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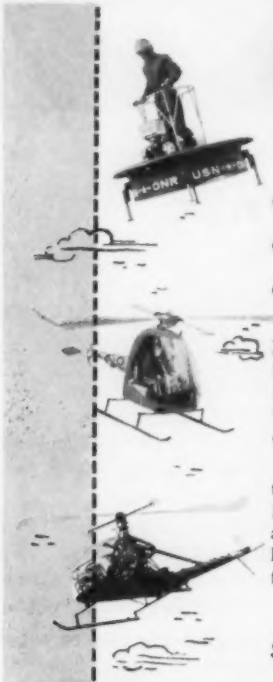

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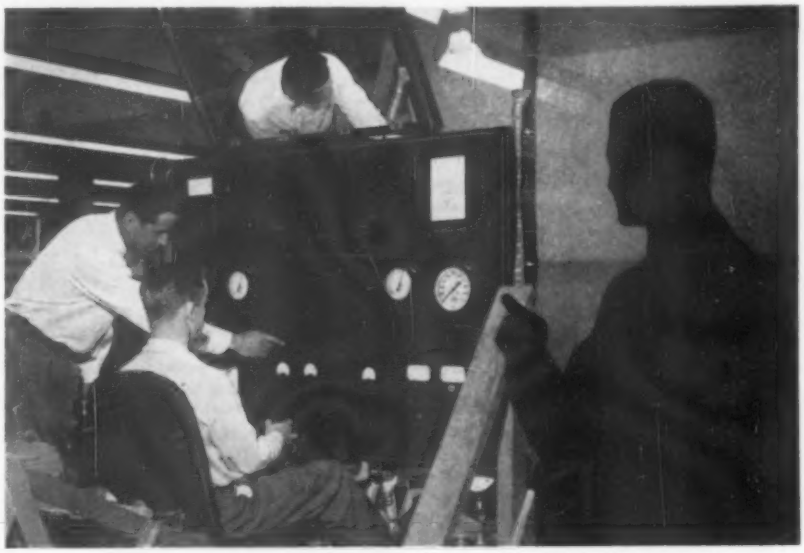

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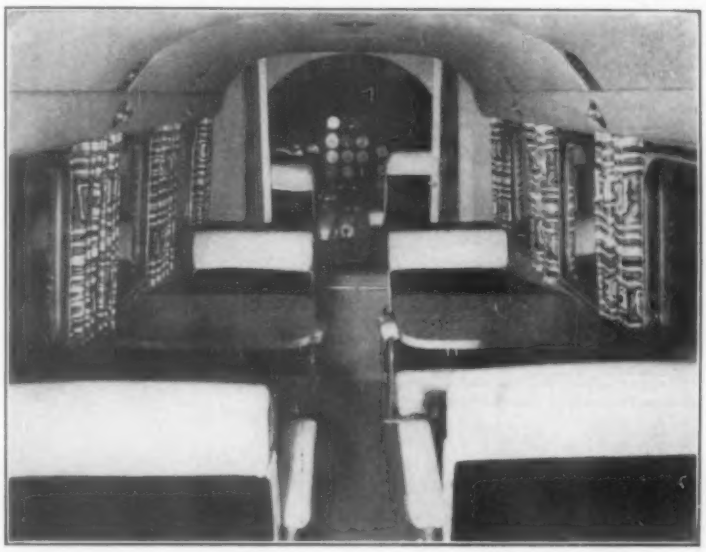

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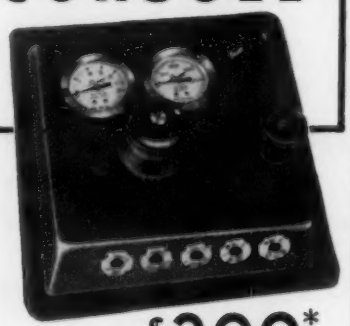

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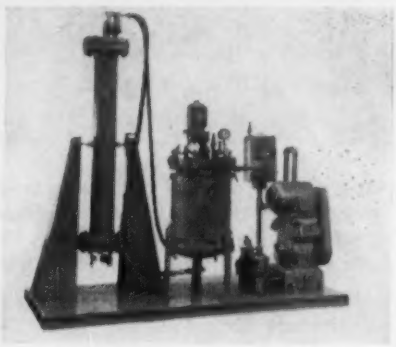
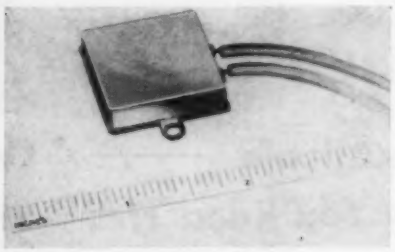


Missile Noses Made Airtight

Vacuum impregnating unit makes plastic nose sections for guided missiles airtight by using polyester resins. Carbon steel chamber, pivoted at midpoint, is said to be capable of withstanding 500 psi. internal pressure and full vacuum. Inert gas is used to increase the penetration of the impregnant in the nose covers.

Storage reservoir, fitted with an agitator to stir impregnant, has a removable top and bottom for cleaning. Liquid trap in the vacuum line prevents impregnant from being carried over into the vacuum pump.

F. J. Stokes Machine Co., Philadelphia, Pa.



Flat Surface Thermal Switch

Hermetically sealed thermal switch is designed for easy mounting on flat surfaces such as aircraft heaters or wherever skin temperature control is desired. It uses a bimetal element and stainless steel case.

The electric rating is 115 v. a.-c. 2 amp resistive; environmental temperature range is −65 to 800 F; calibration range is from −20 to 600 F. Size is 1x1x¼ in.

Control Products, Inc., Sussex St., Harrison, N. J.

Auxiliary Power for Missiles

AiResearch auxiliary power unit, Model APU-1, for electrical and mechanical operation of guidance and control systems of short-range guided missiles, utilizes solid-propellant gas generator. The unit is said to be capable of withstanding shocks, vibrations, accelerations and temperature extremes normally encountered in missile application.

Rated combat operation time is about 60 sec. at 30F, which can be increased to 120 sec. Control of both air and hot gas operation is accomplished with a speed-sensitive governor which contacts a micro-switch to activate a solenoid-operated diverter valve in the nozzle exhaust.

AiResearch Manufacturing Co., Los Angeles, Calif.

Analyzer Checks Plane Controls

Model 405 flight control system analyzer automatically plots aircraft control system characteristics. Electric actuator moves control stick or rudder pedal and driving force is measured by a force transducer. Displacement of corresponding control surface is transmitted to a three-turn potentiometer.

Force and displacement signals are recorded on X and Y axes. Hysteresis curve is automatically plotted as the actuator moves the stick or pedal. Instrument is said to be adaptable for laboratory use as a verifier for original system designs.

Gray & Huleguard, Inc., 930 N. Hancock Ave., Los Angeles 46, Calif.

Aluminum Extrusion Press

New 1,700-ton long-stroke oil hydraulic press accommodates billets up to 27 in. in length. Aluminum press is arranged for automatic and single-cycle pushbutton control from a pulpit-type control station. Pump is a multiple-piston type with servo motor control and is directly driven by a 900-rpm. electric motor.

Operating speeds are 600 in./min.; extrusion 35.5 in./min.; return 300 in./min. Press with runout table is 120 ft. long, 13 ft. high and 12 ft wide. Total weight is 100 tons.

Watson-Stillman Co., Div. of H. K. Porter Co., Inc., Roselle, N. J.

47

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The Navy's newest jet fighter plane, the XF8U-1—designed to operate from aircraft carriers at supersonic speeds—combines a high rate of climb, exceptional combat ceiling, and penetration of the speed of sound in level flight. Contributing to its high performance record is the optical precision of its Swedlow-produced transparent canopy and windshields. Swedlow's outstanding reputation for scientific accuracy in transparent glazing applications accounts for Swedlow's selection as supplier for so many important developments in the aircraft field.

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MM & MP SERIES

This ultra-small d-c relay occupies less than ½ cu. in. mounting space! It's stable under vibration and shock ...plated to prevent corrosion. Operate time is 5 milliseconds. Contact rating: .5 amp. or 1 amp.

MINIATURE TELEPHONE TYPE

TQ SERIES

Only .94 cu. inches in size, yet this relay carries 5-amp. loads in any combination up to 4 PDT. Mechanically secured throughout, it's extremely efficient. No gassing or bubbling. Withstands 10G vibration. Temperature range: —55° to +125° C.

Hermetic enclosures on these types are impervious to varying climatic conditions... are sealed and carefully checked against leakage.

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Electronic repeat cycle timer is used in sign flashing, life testing, bag filling, refluxing and automatic weighing. Model No. 4 utilizes an electronic circuit with two cold cathode triodes. Output is a single pole-double throw relay with 5-amp. contacts. Timer is available for panel mounting or in a 3x4x5 in. box—G. C. Wilson & Co., 1915 Eighth Ave., Huntington, W. Va.

Torque control clutch for power screwdrivers has range of 5 to 85 in./lb. and is easily adjusted to the desired torque. Limiter is always completely re-engaged and ready for instant action whether the operator works with the power on continuously between operations or goes onto the work with a dead motor. The limiter can be used on any available power source, from hand tools to automatic multiple spindle drills.—Livermont, Inc., Maple and Myrtle, Monrovia, Calif.

Portable graphic recorder may be used directly as a recording millivoltmeter or as a means of recording pressure, light intensity and temperature with appropriate transducers. Model G-10 weighs 15 lb., measures 10 x 7½ x 8 in. and features a standard full-scale response time of 2.5 sec. and a standard sensitivity of 100 mv. full-scale. Accuracy is 1% and maximum allowable signal source resistance is 0.5 megohms.—Special Products Div., Varion Associates, 611 Hansen Way, Palo Alto, Calif.

Portable measuring instrument performs both d.c. null detection and linear deflection measurement. The magnetic null indicator weighs 16 lb. and measures 7x8x12 in. It features low noise level of less than 2 mv., high stability, a zero drift of less than one division per hour. Linearity of the instrument, ±5%, provides accurate production testing of precision resistors, potentiometers, capacitors and other electrical components where the deviation from zero must be measured.—Doelcam, Division of Minneapolis-Honeywell Regulator Co., 1400 Soldiers Field Rd., Boston, Mass.

Electric motor driven hydraulic oil pump, Model RG-6100E-1, is designed as a line mounted lubricant pump to feed MIL-0-5506 oil to hydro-mechanical clutch in helicopter transmissions. Unit pumps 5 gal. in 20 sec. with oil at 70F. Rated at 15 gpm. continuous duty when oil is above 160F.—Lear, Inc., Lear-Romec Division, Elyria, Ohio.

Aluminum alloy disk hand wheels crank shafts on jigs and fixtures. Available in four- and five-inch sizes, wheels feature finished OD with boss faced off and centered.—Jergens Tool Specialty Co., 712 E. 163 St., Cleveland, Ohio.

Tubular muffled furnace, especially designed for high-temperature copper and silver brazing of stainless steels, can be used for annealing, sintering and general heat treating work. Uniform heat distribution is provided by cylindrical elements which completely surround the heavy-duty Inconel tubular retort. Available in various size retort diameters and lengths and with temperatures to 2,100F.—Pacific Scientific Co., 1430 Grande Vista Ave., Los Angeles 23, Calif.

Rotary hopper feeding system incorporates a Model 180 Feedmatic hopper with power feed tracks that feed parts three to five times faster than by hand. Rated output system is 4,500 corrected parts per hour, per track. System can also be used with sorting, counting and inspection operations.—Feedmatic Inc., 22519 Telegraph Rd., Detroit 19, Mich.

Acceleration testing machine tests and calibrates small assemblies while subjecting them to multiples of gravity. Model CK9X is capable of subjecting up to a 5-in. cube, weighing a maximum of 3 lb., to accelerations up to 250G. Electronic controller furnishes a speed range up to 1,000 rpm. with precise speed control.—Schaevitz Machine Works, Camden 1, N. J.

Semi-finished hot-formed nut made by the upsetting process, is said to be geometrically perfect with tolerances heretofore impossible in hot-made products. Tool marks, rough edges and pitted cold work areas are eliminated. Nuts are available in ten sizes from ¼ to 1½ in. They may be galvanized, plated or painted.—Pittsburgh Screw & Bolt Corp., Pittsburgh 30, Pa.

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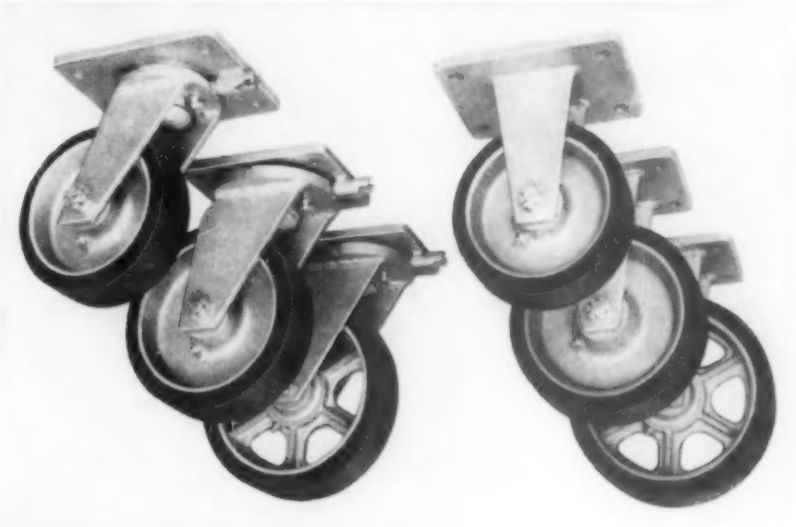
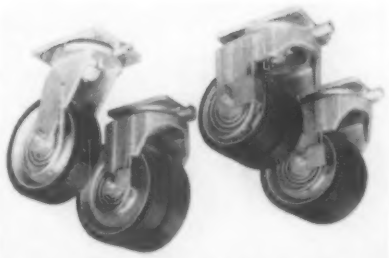
New Bassick "MilSpec" Casters meet military specifications



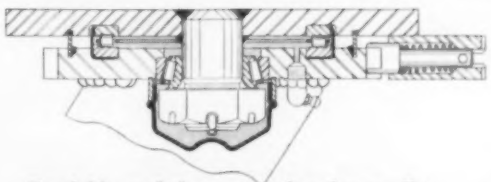
Bassick's new "MilSpec" line is specifically designed and engineered to meet the requirements of MIL-4749 and MIL-C-4750 for precision swivel and wheel bearings, sealed bearings, adjustable swivel bearings.

The new line includes 8, 10 and 12 in. heavy-duty, swivel and rigid casters for both inside and outside service on either hand- or power-pulled materials-handling equipment.

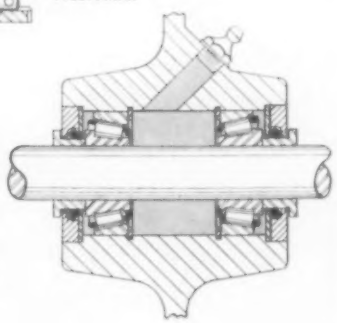


The swivel bearings are self-contained, precision units of the highest quality. Wheel bearings are the finest tapered type. Threaded king bolt and slotted nut construction make fine adjustment of swivel bearing possible.

"MilSpec" sealed swivel and wheel bearing assembly



Gray areas show lubrication reservoirs.



Bassick's sealed construction keeps dirt, water and foreign matter out of both wheel (right) and swivel bearing (above) assemblies of "MilSpec" casters. Protective lubricant stays in to prolong life and insure easy action. Alemite pressure-type grease fittings permit flushing and re-greasing with standard grease guns.

MilSpec "Floating-Hub" Caster gives safe ride

Important in the new "MilSpec" line is Bassick's famous "Floating-Hub" caster.

Smothers shocks

It combines the shock absorption of "Floating-Hub's" sprung-wheel construction with the precision quality of "MilSpec" casters. MilSpec "Floating-Hubs" give any load a safe ride — should be first choice in handling any equipment subject to damage in moving.

Tops on rough terrain

They're also better suited for higher speeds and rougher terrains than ordinary casters. And with adjustable precision sealed bearings, MilSpec "Floating-Hubs" will stay on the job long after lesser casters call it quits.

Write for information

Write to Bassick for printed data on the new "MilSpec" casters. Remember — an original investment in quality casters pays off in added years of trouble-free, money-saving performance. Specify Bassick casters and you'll be sure you have the best.

There is an authorized distributor of Bassick casters conveniently located to give you service. He's always a good source of information about new product developments.

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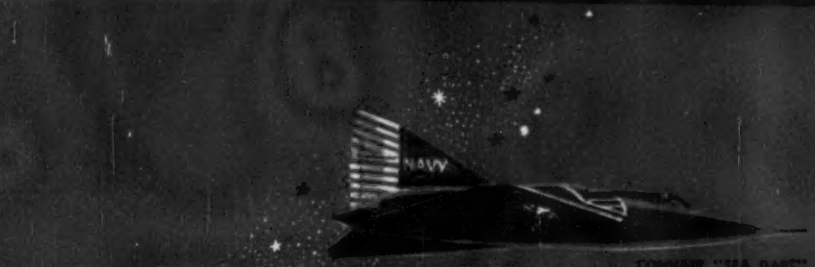

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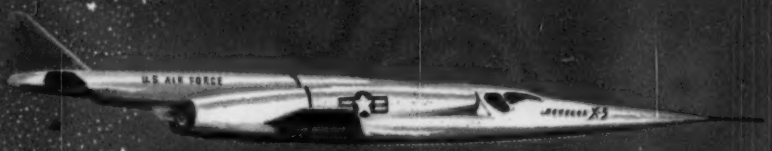

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CFT25
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F2VF40
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BOMBERS
FIGHTERS
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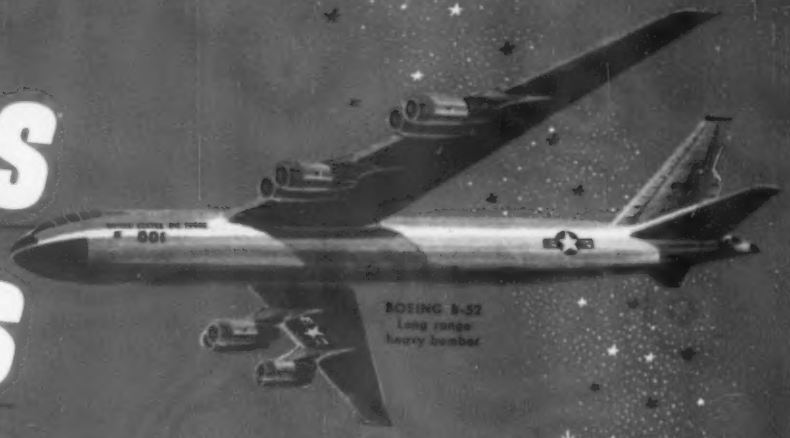

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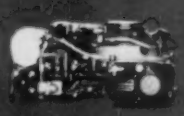

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That's why the Royal Canadian Air Force drew up specifications for a *night* and day interceptor . . . long range and all-weather, with the fire-power of a destroyer . . . to defend the skyways of its vast, northern frontier.
The specifications were met by Avro Aircraft Limited of Malton, Canada. The interceptor is the Avro CF-100.
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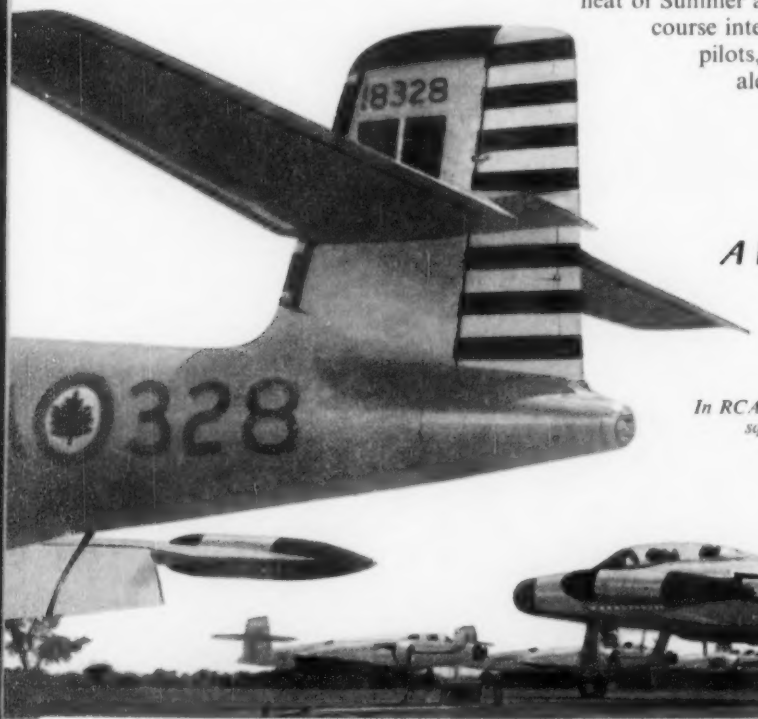
At RCAF stations across Canada, around the clock, in the heat of Summer and frigid cold of Winter, collision course interception exercises with the Avro CF-100 keep RCAF pilots, navigators and ground crews alert against aggression.



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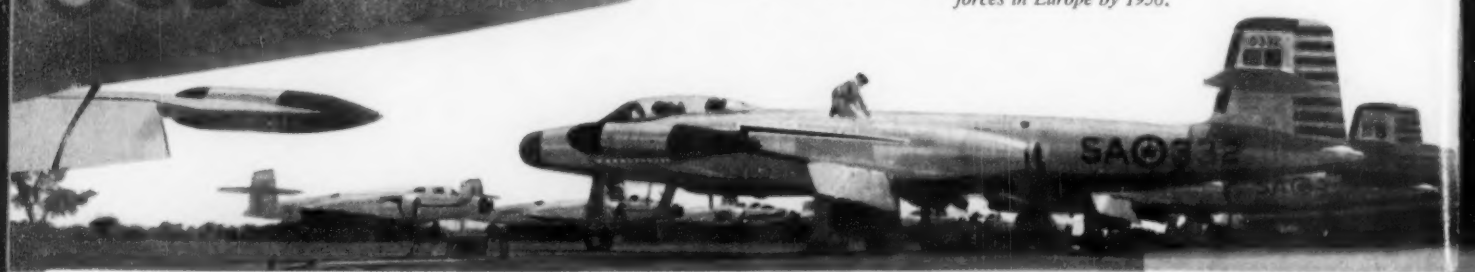
In RCAF operational multi-squadron service in Canada, squadrons of CF-100s will begin duty with NATO forces in Europe by 1956.



Capital Wins East-West Nonstop Routes

CAB gives Northwest Chicago as stop on New York flights, denies scheduled service to North American.

By Craig Lewis

Washington—Capital Airlines has been installed as a full competitor in the lucrative New York-Chicago service area by the Civil Aeronautics Board.

In the New York-Chicago Service Case, CAB has decided to adjust Capital's route structure to make the carrier an effective competitor of American Airlines, Trans World Airlines and United Air Lines on routes between New York and Chicago.

The Board also added Northwest Airlines to the New York-Chicago run by naming Chicago a point on Northwest's Milwaukee-Detroit-New York route.

In its decision, CAB chose to promote competition by adjusting routes of carriers already operating in the area rather than by inserting new carriers into the route structure as it now stands.

Here are the new routes and services awarded in the case:

Capital

Capital's certificate is amended to permit unrestricted service between New York and Chicago, Detroit, Pittsburgh and Toledo. The carrier also was chosen for competitive service between Philadelphia and Cleveland and Detroit.

Capital was given a new route segment between New York and Detroit via Rochester and Buffalo.

Northwest

Northwest's transcontinental route was altered by the addition of Chicago as a point on through flights, subject to a long-haul restriction. NWA will provide a third competitive service between New York and Detroit.

Trans World

Detroit is added to TWA's New York-Chicago route with a long-haul restriction.

An investigation is now scheduled to determine whether another carrier should operate TWA's Detroit-Cincinnati route.

United

United is freed from restrictions against turnaround service between Philadelphia and Detroit. The carrier is also relieved of a restriction from serving Fort Wayne, Ind., on flights to Detroit or Toledo.

Eastern

Eastern Air Lines' Pittsburgh "closed door" restriction is lifted, permitting EAL to carry passengers to Akron, Cleveland and Detroit on through flights.

The decision was based on the twin purposes of promoting competition in the area and strengthening the smaller trunk carriers.

The Board believes that the selection of Capital for the new services "will in the long run contribute most to the development of a sound route structure for the nation.

"We believe," CAB said "that the services we are authorizing for Capital are typical of the kind of service especially suitable for operation by a regional carrier and will contribute substantially to the strengthening of Capital's system, an objective which we consider of great importance in perfecting the route structure of the nation."

Restrictions Removed

In addition to strengthening of Capital's route structure, CAB feels that selection of a regional carrier offers greater benefits to the public than the choice of an inter-regional or transcontinental carrier, since Capital will be primarily interested in short haul markets involved in the new structure.

The Board notes that Capital has been a leader in the development of aircoach and feels its selection will stimulate the growth of coach service in the area.

CAB removed various restrictions in Capital's certificate. Removal of the restrictions allows Capital to operate nonstop and turnaround services between New York and Chicago, Toledo, Detroit and Pittsburgh and establishes a fourth major competitor in heavily traveled eastern markets.

Applications Deferred

Capital's new Detroit-Buffalo-Rochester-New York route will compete with current American Airlines service to northern New York State. The issue of service between New York and Syracuse is deferred for later consideration.

The order adds Philadelphia as a point between New York and Pittsburgh on Route 14 and between New York and Harrisburg on Route 55. Capital is restricted from operating locally between Pittsburgh and Philadelphia pending a later decision on the issue.

Applications for service to Pittsburgh by Capital, Northwest, Eastern, American, TWA and United are deferred for consideration in various other proceedings.

The basic purpose of adding Chicago to Northwest's transcontinental route was to strengthen the carrier's through flight services with the substantial air market available at the Midwest traffic hub. Northwest is currently the only transcontinental carrier which can't tap

North American Turned Down

North American Airlines' chances for certification in route cases pending before the Civil Aeronautics Board were dealt a serious blow in the New York-Chicago decision.

In denying the North American application, CAB said it cannot find the aircoach operators "willing" to comply with the Civil Aeronautics Act and CAB regulations. The Board says its conclusions are based on facts which show that "Messrs. Weiss, Lewin, Fischgrund and Hart, the central figures in the North American group, have a long history of association with flagrant violations of the Act and cannot be found sufficiently reliable to entrust with the operation of the certificated routes they proposed. . . ."

Meanwhile, North American won a stay of the Civil Aeronautics Board cease and desist order from the U. S. Circuit Court of Appeals pending hearing and final disposition of the Board decision putting the company out of business (AW July 11, p. 107). The non-scheduled airline group was turned down on its challenge of CAB's appearance in the case instead of the U. S. Attorney General.

The court stay means that North American will continue two practices objected to by the Board:

- **Using a common ticket agency.**
- **Using tickets without the operating company's name on the ticket at the time of sale.**

UAL Predicts 17% Cargo Gain

United Air Lines expects its total air cargo volume to increase 17% to 40,050,000 ton-miles during 1955 and freight operating revenues to gain 13% to $8.5 million. For 1956, UAL predicts a higher rate of increase after it receives five Douglas DC-6A Liftmasters and converts two more DC-4s to airfreight configuration—more than doubling the airline's all-cargo lift.

The projected increase compared with 24,262,000 freight ton-miles for 1954, 22% higher than 1953's 28,137,000 ton-miles, and revenues totaling $7,519,000, a gain of 23% over the previous year's $6,132,000. Daspite the decline in percentage increase, United's outlook is considerably higher than the 5% maximum predicted for U. S. airfreight carriers by Robert W. Prescott, president of the Flying Tiger Line (AW July 18, p. 7).

"So far as United is concerned," says R. L. Mangold, superintendent of cargo sales, "the plateau is nowhere in sight." Efforts by UAL to develop airfreight include:

- **Extension of reserved cargo space through agreements with Pan American World Airways, Airwork Atlantic Ltd., KLM Royal Dutch Airlines, Qantas Empire Airways, Sabena Belgian Airlines and Swissair.**
- **Plans to build a prototype airdock at a major airfreight terminal. A full mockup of the device—equipped with a fixed conveyor, belts, hydraulic hoists and an automatic sorting table to speed off and on loading—was tested in Denver last year (AW Nov. 29, 1954, p. 76).**
- **Construction of a San Francisco airfreight depot that will serve as a prototype for terminals to be built in the future at key cities. The new depot has 9,000 sq. ft. of floor space and temperature-controlled areas for perishable freight.**

the Chicago market on its east-west services.

While the decision adds a fifth carrier to the New York-Chicago route, Northwest will benefit mostly from service improvements for passengers flying from west of Chicago. The New York-Chicago flights must terminate or originate in New York or in Minneapolis/St. Paul or beyond.

Northwest becomes a major competitor in the New York-Detroit market through removal of through flight restrictions on the route. The Board finds that the New York-Detroit market, second only to New York-Chicago in the area, can support three turnaround services—by American, Capital and Northwest.

TWA Route Improved

A suggested interchange between Northwest and Capital at Chicago is rejected by CAB.

The Board has added Detroit to TWA's Chicago-New York route segment with a long-haul restriction. All flights must be scheduled between New York and Kansas City or beyond. A restriction calling for a stop on flights between Detroit/Los Angeles, San Francisco/Phoenix has been removed.

The addition of Detroit to the TWA route integrates the city into TWA's transcontinental system, an improvement over its position as a terminal on a north-south stub end route.

TWA has said it is willing to surrender its Cincinnati-Detroit sub end route, and the Board has started an investigation to determine whether the route should be transferred to another carrier.

The "closed door" restriction on Eastern's service at Pittsburgh has been temporarily lifted. Eastern will be able to carry passengers from Pittsburgh to Akron, Cleveland and Detroit on flights which originate or terminate at Roanoke, Va., or beyond. The new authority is effective until 60 days after decision in an investigation of Northwest's restrictions on Pittsburgh-Cleveland-Detroit service.

Restrictions Lifted

United has two restrictions lifted in the New York-Chicago decision. The carrier will be allowed to operate turnaround service between Detroit and Philadelphia and can serve Fort Wayne on flights serving Detroit or Toledo.

Applications of Eastern, Braniff Airways, Colonial Airlines, National Airlines and North American Airlines for new routes in the area are denied, since the Board has chosen to improve the route structures of carriers already operating there.

While Colonial's route structure is in need of strengthening, CAB questions the public benefits of the service proposed by the carrier since Colonial asked to serve intermediate points with DC-4 aircraft.

Adams Dissents

CAB Vice Chairman Joseph P. Adams disagrees with the majority on the issue of aircoach service in the New York-Chicago area. He approved the routes and services granted in the decision, but he would defer decision on the applications of National and North American for a year since they have both proposed to offer all-aircoach service. During the year, according to Adams, CAB could assess the results of the present route awards in coach development, then make a final decision.

"The under-development of coach passenger traffic at this late date between New York and Chicago," said Adams, "and between these two cities, on the one hand, and the major intermediate points, on the other, of Detroit, Cleveland, Pittsburgh, Buffalo and Philadelphia, is to my mind one of the most striking features of this entire New York-Chicago proceeding.

"I am convinced that it is of sufficient importance to require us in the best interests of the more than two million annual air passengers traveling in this area, to take at least some action to see to it that low fare air coach service will be provided either by the existing carriers in the area or by other carriers, the past record of which indicates unquestionably their real interest in the low fare air passenger."

INSAC Remote Control To Be Tested Soon

A test for remote control of Interstate Airways Communications Stations (INSACS) will be carried out by the Civil Aeronautics Administration starting Oct. 1.

The 90-day evaluation program is aimed at determining whether an INSACS can be operated successfully from an adjacent station and thus permit expansion and increased service, according to CAA Administrator Fred B. Lee.

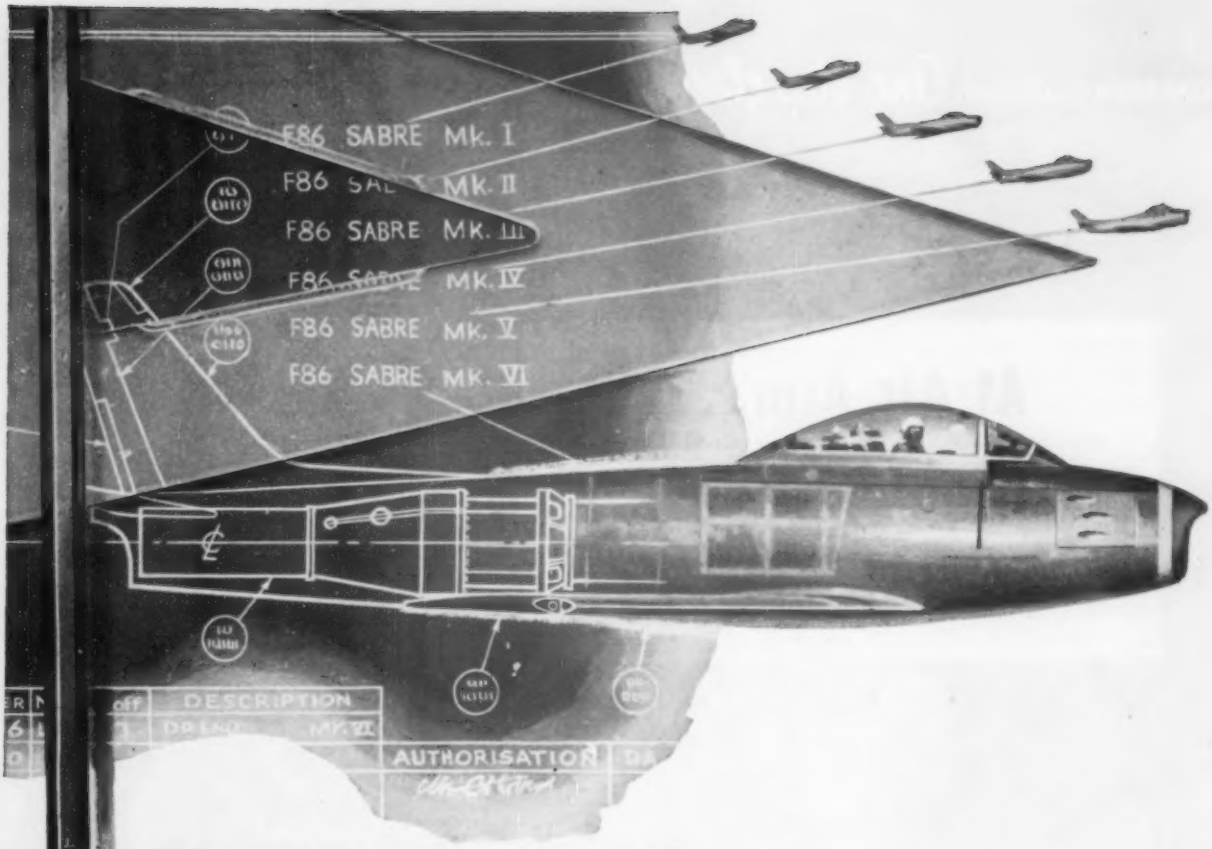
CAA had originally intended to drop approximately 30 INSACS during the year but was prevented from such action by the Senate Appropriations Committee.

In its tests, CAA theoretically will combine the functions of six INSACS. This will be done at three sites.

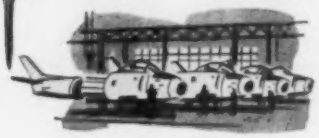
They are the Front Royal, Va., station to be operated from Martinsburg, W. Va.; Green Bay, Wis., tied in with Wausau, Wis.; and the Fort Bridger, Wyo., facility to be remotely controlled from Rock Springs, Wyo. Aim of the tests will be to achieve economies without impairing the efficiency of INSACS operations.

New Viscount Base

British West Indies Airways is setting up a new maintenance base for Vickers Viscounts at Miami International Airport. The turboprop transports are scheduled to replace piston-engine Vikings in November on BWIA's routes from Miami to Nassau and Jamaica.



Whatever the aircraft . . .
Development counts at **CANADAIR**



It was recently announced that the latest Canadian-built F86 Sabre jet fighter can fly faster and climb higher than any other aircraft in European squadron service . . . practical evidence of Canadair's superior development and production facilities.

This is the sixth version of this famous fighter which has been produced continuously at Canadair without interruption of scheduled delivery dates. The outstanding record of the Orenda-powered Sabre VI can be credited to the intricate re-engineering of the airframe to take full advantage of the aircraft's new power plant — the Canadian Orenda 14.

In this job, as in the work now going on at Canadair to design and produce the CL.28, a maritime reconnaissance version of the Bristol Britannia, the RCAF depends on the imagination and "know-how" of Canadair's engineers. Like so many aviation experts around the world, they know that in every aspect of production, "You can count on Canadair".

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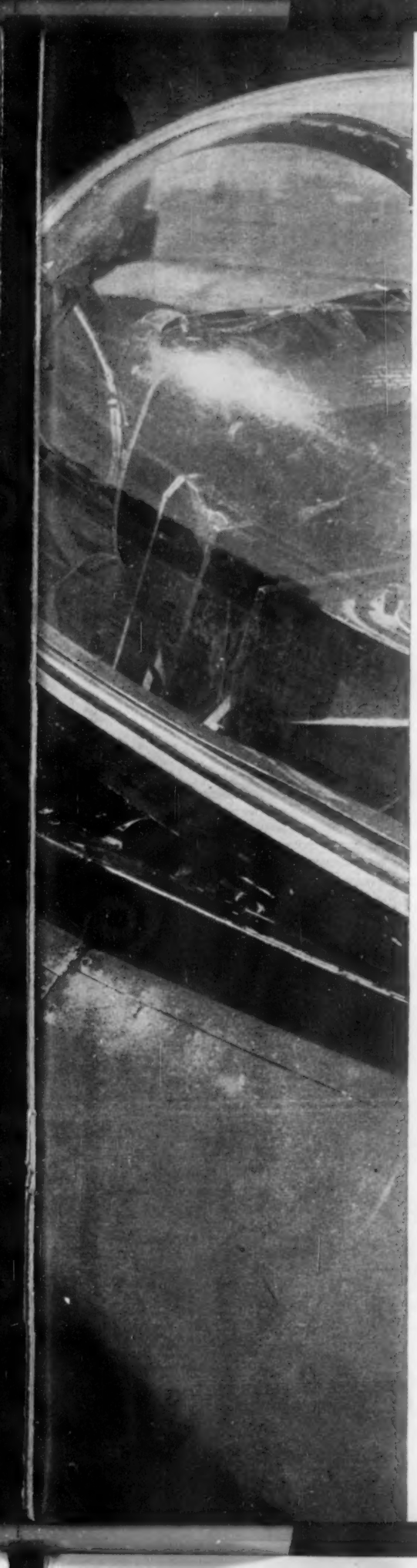
At Air Arm... flight testing is FIGHT testing



Air Arm has what it takes to develop and produce the best in airborne electronics equipment. A key factor is the Flight Test facility that puts systems through actual tactical situations . . . a facility that is second to none in the industry.

Far from being a fledgling in this activity, Air Arm's Electronic Flight Test Center is three years matured and still expanding. This unique facility is at the main plant and connected by taxi strip to Baltimore's modern Friendship International Airport. Westinghouse owned and operated, it consists of 48,000 square feet of hangar area, electronic test and administrative sections.

FIGHT Testing airborne systems is the job of Air Arm's Flight Test Center. Here, eight former military pilots, men with aviation backgrounds which total over a century of flying experience, keep as many as 16 prop and jet aircraft on the go. They subject equipment to every possible airborne rigor *before* it goes into operational aircraft. 110 highly trained and experienced Flight Test personnel—engineers, technicians, mechanics, armorers and aerologists are working hand in hand to insure that pilot, aircraft and airborne system form a perfectly matched combination for peak efficiency and performance.

Air Arm Flight Test is one of the many specialized facilities which enable us to produce the best in airborne electronics equipment and . . . to help you bring tomorrow's aircraft . . . One Step Closer. Westinghouse Electric Corporation, Air Arm Division, Friendship International Airport, Baltimore 27, Maryland. J-91030-B

Chief Project Pilots, Tom Lloyd and Fred Hughes, join on the ground, prior to debriefing, following an afternoon air-to-air gunnery check on a fighter armament system.

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- Bomber Defense
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is one of the many specialized
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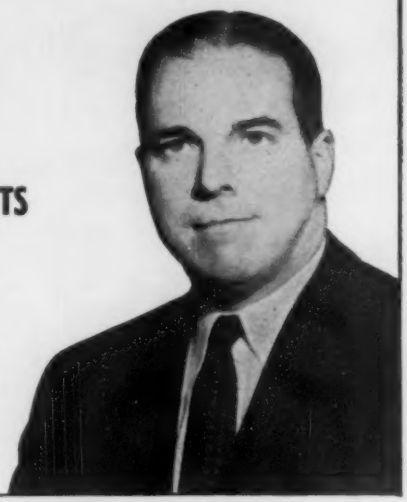
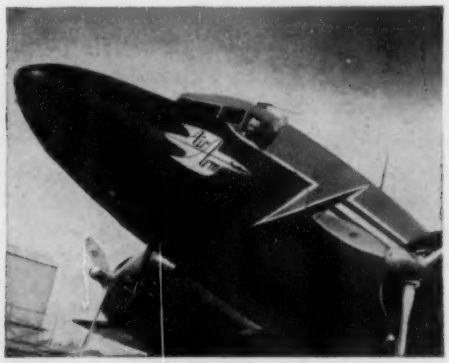


Mr. M. T. Lang

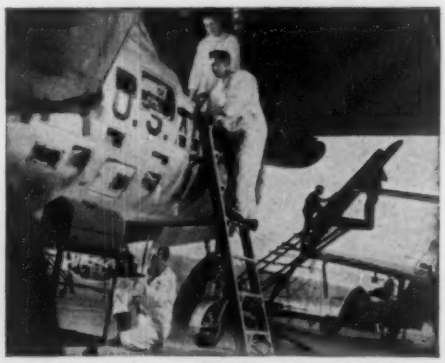
Can Milt Lang help you? Contact him at Westinghouse Electric Corporation, 501 St. Paul Place, Baltimore 2, Md. Telephone PLaza 2-0300. Or see his counterpart in your area through your local Westinghouse office.



Bill Tyler, in charge of flight activities at the Center, applies his experience to the operation of flying test beds. In the Air Arm DC-3 Flying Lab, equipment gets a positive assessment of flyability.

Tom Lloyd, a chief project pilot, holds briefing with project and supervisory engineers. Finding the difference between simulated and actual performance is the reason for Air Arm Fight Testing.

A new fire control system is getting this Air Arm shakedown, using the DC-3 Flying Lab as the proving ground. All equipment gets this evaluation under actual in-flight tactical situations.



Complete support to operate flying test beds is an integral part of Air Arm. Maintenance is done on all types of aircraft by experienced ground crews using the finest equipment and hangar facilities.

J-91030-A

YOU CAN BE **SURE**...IF IT'S **Westinghouse**

TWA to Fly Cleveland-New York; UAL Gets Nonstop Seattle Route

Civil Aeronautics Board has given Trans World Airlines a Cleveland-New York route and United Air Lines nonstop rights from the Pacific Northwest in two cases decided with the New York-Chicago Service Case.

A segment of TWA's Route 2 has been extended from Cleveland to New York in a portion of the reopened Milwaukee-Chicago-New York Restriction Case dealing with Cleveland-New York nonstop service.

In the United Restriction Case, CAB has lifted a restriction which currently prohibits nonstop service between Portland-Seattle and Chicago.

Cleveland Service Aided

Both cases has been deferred for decision in conjunction with the New York-Chicago proceeding. The decisions are based on findings in the larger case.

The award of the Cleveland-New York segment eliminates Cleveland as a stub-end terminal and integrates the city into TWA's transcontinental route structure. Flights serving Cleveland and New York must originate or terminate at St. Louis or beyond.

The new route segment is designed to permit TWA to use modern equipment in its Cleveland services. The basic aim of CAB is to improve service between the Ohio city and beyond Chicago.

United Restriction Removed

TWA's position as a vigorous air-coach promoter is viewed by the Board as an additional service advantage for Cleveland. TWA will compete with American and United west of Cleveland and Capital and United to the East.

In the United Restriction Case, CAB decided to permit United to operate nonstop between the Pacific Northwest and eastern points. Currently, the carrier must make a stop on flights between points in the Pacific Northwest and east of Salt Lake City.

CAB finds that removal of the restriction will result in considerable improvement in service because of the elimination of mileage circuity involved in stopping at a point such as Denver on through flights.

Removal of the restriction is approved by the Board on the basis of awards made to Northwest Airlines in the New York-Chicago Case. The addition of Chicago to Northwest's East-West Route and the granting of New York-Detroit turnaround service will balance the added competition of United nonstop, CAB stated.

3 Lines to Compete Louisville Nonstop

Nonstop air service between Louisville and New York has been authorized by the Civil Aeronautics Board.

CAB has approved the new service for Eastern Air Lines, American Airlines and Trans World Airlines. All three carriers now fly the route on a restricted basis.

The Board has decided that traffic has developed sufficiently since its 1950 decision on the nonstop issue to warrant lifting of the nonstop restrictions on the three carriers. Currently, Eastern must stop at Washington, American must stop at Cincinnati and TWA must stop at either Cincinnati, Dayton or Columbus, Ohio, or at Pittsburgh.

CAB estimates that about 50,000 passengers annually will benefit from the improved service. Louisville-New York traffic increased from 17,000 passengers a year in 1948 to 41,000 in 1954, a 140% increase.

On the issue of who should operate the nonstop service, Eastern maintained that only one carrier should get it, while American and TWA favored authorization of all three.

Eastern told CAB it should have the authorization because it is the pioneer operator in the area and has done more to develop traffic between the two cities than the other two carriers.

In authorizing all three carriers to perform the service, the Board said that its duty is to protect the traveling public rather than the private financial interest of any one carrier. CAB points out that since all of the carriers involved have been self-sufficient for many years, there is no longer any need for protection from competition.

Weight Rule Extended

Civil Aeronautics Board has proposed a five year extension of the special authorization for provisional maximum take-off weights for certain aircraft of 12,500 lb. or less operated by Alaskan air carriers and the Department of Interior in Alaska. The present regulation, SR-399, was adopted two years ago and expires Oct. 25, 1955.

In its notice of proposed rule making, CAB pointed out that a five year extension of SR-399 was required and during its notice of proposed rule making, CAB pointed out that a five year extension of SR-399 was required and during that period it should be determined whether or not such authorization will be made a part of the Civil Air Regulations. Industry comments are to be submitted not later than Oct. 11.

New BOAC Headquarters

New headquarters—four hangars and executive offices—of the British Overseas Airways Corp. at London Airport with BOAC Stratocruiser in foreground. Airline officials say the rambling structure, with a total floor space of seventeen acres, is the largest concrete structure of its kind in the world. The hangars—one at each end of the building—have 300-ft.-wide door openings and cover just over one acre of ground each.

PAL May Resume Pacific Flights in '56

Philippine Air Lines probably will revive trans-Pacific flights by mid-1956, more than two years after the carrier dropped all long range international routes as an economy measure (AW April 5, 1954, p. 11). PAL officials are preparing a proposal for the government, largest stockholder in the airline, that will be submitted to the Philippine congress next January. PAL spokesmen say resumption of service will depend on a government franchise, guaranteed mail rate of 62½ cents per ton-mile and purchase of new overseas transports.

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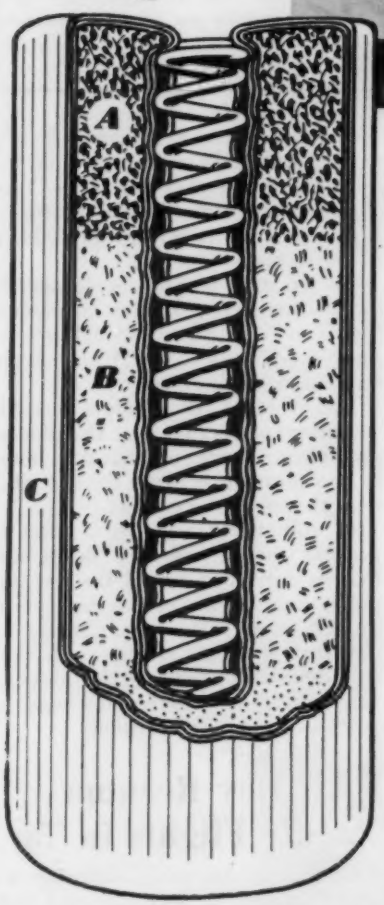

(A) CP* material accepts varying percentages of oil flow, to maintain acceptable pressure on the scavenge pump system.
(B) Combined soft threads and cellulose absorb moisture and gums.
(C) The complete double covering (Patented) is also an effective filtering medium.

The first successful application of full-flow filtration for lubricating oil in the engines of passenger-carrying aircraft is the installation of Winslow CP* filters by Pan American World Airways. The first flight was between San Francisco and Kansas City, and has been followed by regular transpacific schedules.

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The development of full-flow filtration is possible only with Winslow's patented CP* elements. This material accepts varying percentages of the total oil flow as conditions dictate; thus maintains acceptable pressure losses without opening by-pass valves, and insures 100% full-flow filtration at all times.

PROVED IN TWO YEARS CROP DUSTING SERVICE

Tests on transport engines were preceded by more than two years experience with Winslow full-flow filters on crop dusters, with more than 400,000 flight hours of service evaluation. Filter elements were changed each 100 to 150 hours. Condition of engine parts made possible substantial increases in service between overhauls, with resultant savings in labor and parts.

Winslow Engineering Company has developed unique methods of installation that overcome problems of weight and space, to provide the economies and safety of full-flow filtration. Tests are now being completed for several types of engines. Write or wire for complete information.

WINSLOW FILTERS

CP is fully protected by patents and trademarks*

55-A-4

Winslow Engineering Company, 4069 Hollis Street, Oakland 8, California

Air Transport Assn. to Propose Coordinated Air Education Plan

Aviation education programs are increasing air travel volume, helping the American public accept aircraft noise and preparing it for the airlines' transition to turbojet and turboprop transports.

To broaden the scope of these programs still further, the Air Transport Assn. is preparing an overall proposal for its member carriers.

ATA's project will be designed to supplement the educational services of United Air Lines, Pan American World Airways, Trans World Airlines and Eastern Air Lines and to give other carriers the advantages of a co-ordinated program. It will be submitted to the association's board of directors next December.

The new program will be directed at the administrators of schools and colleges, the policy-making group of U.S. education. It probably will be patterned after the annual 10-day Aviation Education Institute started by ATA's Public Relations Department in 1952.

Airline Projects

Educational services of the individual airlines so far have been aimed at the class-room level. Major projects include:

• **United Air Lines.** Started in 1940, UAL's School and College Service Department is the oldest education program in the U.S. air transport industry. Director R. O. Mertes says the department's purpose is two-fold: (1) "to survey constantly the needs of schools for materials related to aviation education on all levels from kindergarten through college and adult; (2) to meet as far as possible these needs through publication and distribution of educational literature and through personal services."

The amount of material published by United far exceeds that of any other airline. In 1954, the carrier supplied about 1.5-million charts, booklets and pictures to teachers and students. UAL also was represented by exhibits at 36 teachers meetings, gave 150 lectures before audiences totaling 25,000 persons and conducted another 25,000 through airport tours.

• **Pan American World Airways.** PAA's service is directed at two objectives: (1) help students and teachers understand the basic principles of air transportation; (2) assist them in using air travel as a tool for learning and as a means of achieving national and international understanding.

PanAm works toward these goals through publication of a large amount of material and through talks before school and civic groups by Education Director George Gardner.

The overseas airline also promotes aircraft model building.

• **Trans World Airlines.** Following the objectives of PAA's program and using much the same methods, TWA depends primarily on publication of materials and lectures. In the latter category, Trans World leads the field. Educational Director John Furbay has made an overseas tour and given more than 60 lectures in the United States so far this year.

• **Eastern Air Lines.** EAL is limited to courtesy flights for educational and civic groups and to Business-Industry-Education Day in many cities served by the carrier. The airline does not provide pamphlets or books specifically for schools.

In addition to the major programs, education work on a smaller scale is carried out by Capital, Northeast and Piedmont Airlines.

Educator Support

All of the educational workshops and services are based on the theory that the public will be more tolerant of aircraft noise and other disadvantages of aviation progress if they understand the principles of air transportation.

"The educator is a good man to approach, because he can see and understand the civilizing aspect of aircraft," says ATA's Chapin R. Leinbach. "He starts programs similar to those of the airlines in schools, clubs and civic groups.

"Most educators already have been briefed on the new problems that will come with the transition to jet and turboprop aircraft."

Leinbach cites the crash of an American Airlines' Convair 240 at Albany, N. Y., two years ago as an outstanding example of the support offered by teachers and school administrators. "Upon learning of this (crash)," Leinbach says, "one of the educators in the area, who had attended the 1953 Aviation Education Institute in Washington, volunteered his services to the airline. He said he would be happy to help alleviate some of the adverse publicity which would undoubtedly result from the accident by explaining to the community, which knew him and which he knew, something about airline operations and the efforts that are made to bring the utmost safety to the flying public."

BOAC Earns Profit Without Comets

British Overseas Airways Corp. reports a net profit of $732,723 for the fiscal year ended March 31, despite withdrawal of its de Havilland Comet I jet transports and substitution of U. S.-built piston-engine airliners as stopgap equipment.

The net profit, BOAC's third in the past four years, compares with $2,983,111 for the previous 12-month period. Total operating revenues dropped 3.8% to $103,225,357 from $107,411,743. Air cargo increased to $9,668,517 from $8,238,423, but passenger revenues declined 5.4% to $64,120,327 from $67,766,518.

Expenses per capacity ton-mile increased to 46.6 cents from 45.7 cents, primarily because of prematurely writing off the $1.7-million Comet development expenditure and the cost of re-organization and re-training after the jet transports were withdrawn from service. There also was a direct capital loss of $4.8 million on BOAC's Comet I fleet and equipment and a $1.1 million deficit on disposal of Hermes transports.

The international airline lost 40 million ton-miles, or 21% of the fiscal year's planned capacity, when Comet service was suspended in April 1954. The overall capacity decline was held to 2.6% with acquisition of six Boeing Stratocruisers from United Air Lines and one from Pan American World Airways, increasing BOAC's fleet of 377s to 15. The British carrier also traded seven Lockheed 049s Constellations to Capital Airlines for seven 749 Connies.

BOAC has ordered 33 turboprop Bristol Britannias, 20 de Havilland Comet IVs, 16 Vickers Viscounts and 10 Douglas DC-7Cs.

TWA Offers One-Stop West Coast to Europe

Trans World Airlines plans to inaugurate one-stop service between California and Europe Nov. 1.

TWA will operate the new international service with weekly flights from Los Angeles and San Francisco to London and Frankfurt. Both flights will make a stop at New York.

Combination-class Lockheed 1049G Super Constellations will be used.

The configuration will be similar to the tourist-first class layout recently proposed for nonstop transcontinental service.

The California-Europe flights have been scheduled for 21 hours and five

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minutes between Los Angeles and London. TWA says its schedules are seven hours faster than present polar route schedules to London and four hours faster than polar service between California and Frankfurt.

TWA also plans to add two 1049G flights Nov. 1 between New York and London and Frankfurt. Service from the West Coast to Paris and Rome is planned for January, and to Athens and Cairo next March.

P&WA Equipment

Canadian Pratt & Whitney Aircraft Co. has announced purchase of all government-furnished equipment to become completely privately-owned. The firm plans to invest an additional $1.5 million in new equipment for engine production.

The company will produce R-1820 engines and propeller components for the twin-engine CS2F-1, designed by Grumman Aircraft Engineering Corp. It also plans to produce the J75 jet engine, now in flight test, to power a Canadian-designed fighter. The firm was established 27 years ago. Approximately half of its production is for export.

EAL-Colonial Merger Attacked by National

National Airlines last week made a two-pronged attack on the Civil Aeronautics Board examiner's recommendation for approval of an Eastern Air Lines-Colonial Airlines merger.

In a brief to the examiner, National said: "The newly proposed Eastern-Colonial deal is adverse to the public interest" for these reasons:

- **"Approval of the merger** would render the laws of the country meaningless.
- **"The record in the case** conclusively proves that the price for Colonial being paid by Eastern is exorbitant and outrageous."

National also noted that the filing of a brief should in no way prejudice its motion before the U.S. Circuit Court of Appeals for review and stay of the Board's order limiting the issues in the case (AW Sept. 5, p. 98).

National urged the examiner, the Board and the President to disapprove an Eastern-Colonial merger because "Eastern is a lawbreaker, and the President decided the last time the lawbreaker should not be rewarded." It was claimed by National that the fact Eastern is once again taking up the government's time in the case for its approval of Colonial renders meaningless the laws of the country.

Eastern was further accused by National of monopolistic proclivities. This is indicated, National said, by the amount of "water" in the proposed purchase price of $14,706,950. The "water" in the price exceeds $12 million, it was claimed. National contended that to allow Eastern to pay $14 million for Colonial, or some $12 milion more than its worth, is not sound or proper policy.

National concluded that "to approve this agreement the Board and the President would surrender jurisdiction over mergers in the industry to the carrier with the biggest pocketbook." It suggested that the Board consider available alternatives which are more in the public interest "than an Eastern-Colonial deal conceived in inequity."

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Air Express Meeting

Growing importance of air express in Washington, D. C.—one of the top 10 air express stations in the nation—was discussed last week at a one-day service conference of air express officials of the 10 scheduled airlines serving Washington and representatives of the Railway Express Agency's Air Express Division. Air express flows through Washington National Airport on a total of 323 scheduled flights, providing Washington with direct service to 1,800 cities in the U.S., Canada, Cuba, Alaska and Hawaii.

Hawaiian Shakeup Under New President

San Francisco—Arthur D. Lewis, who stepped up to the presidency of the financially-strained Hawaiian Airlines Ltd. in July, is leading the company through a top-level personnel and operational reorganization.

Lewis, an American Airlines executive before joining Hawaiian as executive vice president early this year, has—among other things—established an economic control division and announced a new policy designed to promote passenger interest and airline trasportation service.

In his reorganization and subsequent moves, Lewis is faced with the crippling

Civil Aeronautics Board decision to refuse extra mail pay for Hawaiian's recently-purchased fleet of Convair-Liners. The line is still appealing the decision.

The new president has hired Jack C. Tobin, presently district sales manager for United Air Lines in Hawaii, to become vice president in charge of sales, transportation services and advertising-public relations. He is presently scheduled to take over the post on Oct. 1.

He has brought in Lambert P. Irons, a former CAB rate analyst, to head the economic control division which will handle cost and traffic analysis, schedule coordination and matters pertaining to the CAB.

Other personnel changes within the year have advanced employes within the company:

• **Lionel Machado** is vice president of operations, maintenance and communication.

• **Lyman Conant** heads personnel and industrial relations.

In addition, David Watson, vice president and treasurer in charge of accounting and purchasing, has resigned but will remain in a consulting capacity.

Lewis replaces Stanley C. Kennedy, a pioneer in the founding of the line in the 1920s, who moved up to the newly-created position of chairman of the board. During the almost 26 years that he headed the line, it operated without a single passenger fatality or serious passenger injury.

SHORTLINES

► **Delta-C&S Air Lines** has started a $250,000 program at Atlanta Airport which includes expansion of maintenance and office facilities.

► **Middle East Airlines** became an active member of the International Air Transport Assn. Sept. 1.

► **North Central Airlines** carried 48,159 passengers in August, an increase of 54% over August, 1954 . . . net profit for North Central in July was $25,431 with 46,408 passengers carried.

► **Santos Dumont Airport** in Rio de Janeiro is being expanded in a program designed to improve the field over its present DC-3 capacity.

► **Swissair** is installing weather radar in its fleet of DC-7Cs. Radio Corporation of America radar equipment will be installed on four DC-7C aircraft scheduled for 1956 delivery.

CAB ORDERS

(Aug. 22-29)

GRANTED:

Mohawk Airlines a one-year temporary exemption for service to and from White Plains, N. Y.

Seaboard & Western Airlines authority to perform one one-way charter flight from London to New York with an intermediate stop to deplane 24 passengers at Halifax, Nova Scotia, Sept. 3.

Hawaiian Airlines Ltd. exemption for period of one year to provide free transportation to one tour conductor when accompanying 15 or more persons traveling as a group on an advertised tour arranged by a travel organizer between points in the Hawaiian Islands.

Mohawk Airlines permission to serve Keene, N. H., on one daily round-trip flight as well as a minimum of one flight daily service at Pittsfield, Mass., provided that service to Albany, Westfield-Springfield, and Worcester is a minimum of two round-trips per day.

Transocean Air Lines authority to operate one DC-4 flight from Rome to New York Sept. 5 under contract to the Inter-Governmental Committee for European Migration.

ORDERED:

Continental Air Lines to show cause why final mail rates should not be $1,386,612 for the future year beginning April 1, 1955 and $1,501,002 for subsequent years.

Okanagan Helicopters Ltd. authorization for pipe line patroling from Sumas, B. C., Canada, to Ferndale, Wash., amended to permit an extension of operations on an intersection of the Sumas-Ferndale line running from Laurell through Burlington to Anacortes.

Dena H. Goodwin, an Alaskan pilot-owner continued authority to operate Noorduyn-Norseman aircraft between points in Alaska in the First Judicial Division and any other point in Alaska, British Columbia and the Yukon Territory until 60 days after a final decision in the Intra-Alaska Route Investigation.

DISMISSED:

The New England-Southern States Merger Investigation and Piedmont Aviation's application for authority to operate over portions of Routes No. 51 and/or 55 of Capital Airlines as moot.

National Airlines' application to serve Tallahassee, Mirianna and Panama City, Fla., and Valdosta, Ga., with limitation for cargo and mail flights only at the request of the applicant.

Catalina Air Transport's application to suspend service for a period of five years because the applicant is abandoning the route and is now surrendering its present certificate.

DENIED:

North American Airlines petition for postponement of the effectiveness of the cease and desist portion of the Board's revocation order beyond Sept. 3.

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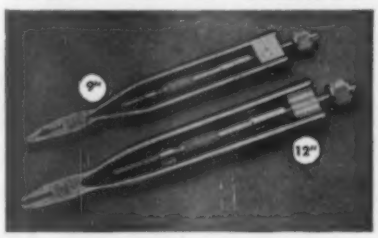

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Echo From ACC

A little more than a year ago (AVIATION WEEK, May 17, 1954, p. 112), this column was devoted to a discussion of air traffic-control experiments the CAA planned to conduct at its Technical Development Evaluation Center in Indianapolis. The comment here was that, while the idea of better control was a noble one, the CAA's place and method were wrong. A dim view was taken of the entire proceedings. For such remarks, I was promptly taken to task by those connected with the program.

The principal point made in this column was that make-believe simulator problems carried out in the thinly-trafficked hinterlands offered a poor substitute for the real McCoy of the Boston-Norfolk airways. Further, I mentioned that—since the CAA would have to face reality some day—they might as well have started then instead of hiding in a laboratory.

CAA Deadline

Well, despite the earlier task-taking, this is what happened in Washington in July at a meeting of the Air Coordinating Committee as reported by AVIATION WEEK, (July 11, p. 112): The "CAA (was) Told to Speed Radar Traffic Control." Among other things, the ACC suggested Boston as the most logical area to conduct the evaluation. Furthermore, the CAA was given August 1, as the deadline for submission of its plan of action.

This brings us to an interesting point—somewhat speculative perhaps—but interesting. Who is it that can "tell" the CAA to get going on a program and make it stick? I want words with this person about airport lighting, flight time limitations, navigation aids and other things.

Obviously, whoever did the "telling" must have been at the ACC meeting. The CAA wouldn't have told itself, would it? Could it have been the military? No—our government is not supposed to work that way. Then could it have been the chairman of the meeting—Under Secretary of Commerce for Transportation Louis Rothschild? Must have been. And if this guess is correct, then three cheers for Mr. Rothschild.

Test Conditions

As I said a year ago, piddling around in Indianapolis is fine for some things but not for developing a country-wide system of traffic control. This thing is bigger than any single agency, and it must be done out in the open under actual conditions.

Apparently the ACC recognized all these angles because it directed the CAA to obtain full cooperation and coordination with the Department of Defense, Air Navigation Development Board and Lincoln Labs.

This new attack is more like it. Aviation has gradually drifted away from the Common System concept of unified effort on its problems. Since the airspace belongs to all users and must serve all their purposes nothing but a single system can possibly suffice.

The thought just occurred that perhaps this "unknown" person might also be able to "tell" somebody to get going on landing aids in the terminal areas—especially the visual aids. With present lighting, much time is consumed whilst pilots grope for the runway. And of course, we should have more than one instrument runway per airport. Unless factors like these are taken care of, a better traffic control system will only be a super highway to the next bottleneck.

(Editor's Note: AVIATION WEEK gives Capt. Robson an opportunity to express himself freely in this column. Comments from readers on his opinions are welcome.)

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The Area Rule Breakthrough

One of the most significant military scientific breakthroughs since the atomic bomb has been contributed to the American aviation industry by the National Advisory Committee for Aeronautics' discovery and development of the area rule for supersonic aircraft design. The first technically accurate and complete story on this concept appears on page 12 of this issue written by David Anderton, assistant managing editor (technical).

The true significance of the NACA area rule lies in its across the board application to supersonic aircraft of all types—extremely simple in the critical transonic range and more complex in the truly supersonic area around Mach 2. The so-called "Coke bottle" or "Marilyn Monroe" fuselage is merely one type of area rule application. Area rule discovery and development were particularly timely because they occurred at the very moment that virtually all USAF and Navy fighters aimed at sustained level supersonic flight were apparently doomed to remain just below Mach 1 because the contemporary crop of jet engines available lacked sufficient power to push these designs through the tremendous drag rise that then existed in the transonic range between Mach .9 and Mach 1.04.

In addition to providing a major scientific breakthrough at the very moment when the technological race with Russian airpower was becoming hottest, the NACA area rule development also will give military and congressional leaders who are concerned over military security problems an object lesson in how a major military scientific secret can be kept effectively to gain a time advantage over international competitors.

First word that something radically new was brewing in supersonic aircraft design first reached AVIATION WEEK in the closing days of 1953. During the early months of 1954 considerable data was accumulated on the "Coke bottle" fuselage, "Marilyn Monroe" supersonic shape, and the "Whitcomb theory"—all loose designations for what was actually the area rule. Since all our data pointed to NACA as the source of what appeared to be a revolutionary new concept in supersonic aircraft design we consulted Dr. Hugh L. Dryden, director of NACA, who in addition to his scientific ability is a man of integrity. After this conference we wrote Dr. Dryden on April 15, 1954 as follows:

"As a result of your very helpful briefing on the security problems involved in the widespread military application of a new development in high speed aerodynamics we have made a policy decision to refrain from any mention of this in Aviation Week until prototype aircraft embodying this principle are open to public view. This decision was made despite the fact that our reporters unearthed the basic facts on the development and its application from a wide variety of technical sources.

"As you pointed out this is too important a matter with which to trifle. . . . We appreciate your counsel in these matters because it helps us to avoid inadvertent disclosures of genuine aeronautical security matters and thus benefits our country."

Dr. Dryden replied on April 20:

"Thank you for your letter of the 15th and the assurances it contained. I think your decision to withhold from public attention the information you have obtained about new developments in aeronautics properly falls in the category of a real public service to the nation."

The real root of the security problem in cloaking the significance of the area rule lay in the fact that there were several earlier theoretical investigations in this field that had been published in this country and in England without any security classification. Wallace D. Hayes then of North American Aviation, and two Britons, G. N. Ward of the University of Manchester and W. T. Lord of the Royal Aeronautical Establishment, had all taken a mathematical approach to the problem beginning as early as 1946 but without the research tool of the transonic tunnel available then, they all concluded that there was not much promise to this channel of effort. The real security in the area rule lay not so much in the indented "Coke bottle" shapes of the fuselage on new fighter prototypes (the Kuchemann Coke bottle design was well known in the United States, Europe and Russia as a result of captured German documents and bears no resemblance to the area rule) as in the fact that Hayes, Lord and Ward were on the right track in their wing-body relationship studies and that many clues could be found in their unclassified publications.

After AVIATION WEEK established its security policy on the area rule with NACA, other publications began to get the same information and after talking with NACA agreed to follow the precedent established by AVIATION WEEK. When the Grumman F11F-1 prototype appeared the fuselage indentations were labeled only as a "drag reducing" feature which was accurate as far as it went. But no mention of NACA, area rule or the application of a basic new principle appeared in the American or foreign press.

In September 1954 the editor of Aero Digest violated that magazine's written commitment to NACA by publishing a fragment of the area rule application to the Grumman Tiger. AVIATION WEEK again consulted with Dr. Dryden on the grounds that if security had been breached we should publish the full story without further ado. Dr. Dryden pointed out that since the published story had appeared in a magazine of limited aeronautical readership it might easily pass unnoticed it it was not picked up and magnified by an aviation magazine well known for its technical accuracy. The missing link to the unclassified data of Hayes, Lord and Ward was still secure as was the scope of the widespread applications to new military aircraft.

AVIATION WEEK decided to continue its area rule security policy unaltered. We wrote to Dr. Dryden on Oct. 5, 1954:

"After our conversation this morning I consulted Bob Martin our publisher. We agreed unanimously to continue our policy of not printing information on this important aeronautical development until such time as there is a general agreement that its security value has diminished to an extremely low value."

Dr. Dryden replied:

"I believe Aviation Week is performing a valuable public service by its decision to continue its policy of not publishing information on this important aeronautical development until such time as there is general agreement that its security value has diminished to an extremely low value. I realize, at least in part, how seriously your publication must have considered this point in view of the recent publication elsewhere of the information about the development in question."

Now that official military security has been lifted on the NACA area rule AVIATION WEEK has brought its readers the first technically accurate and complete story on this subject and honored its security agreements to the letter.

—Robert Hotz

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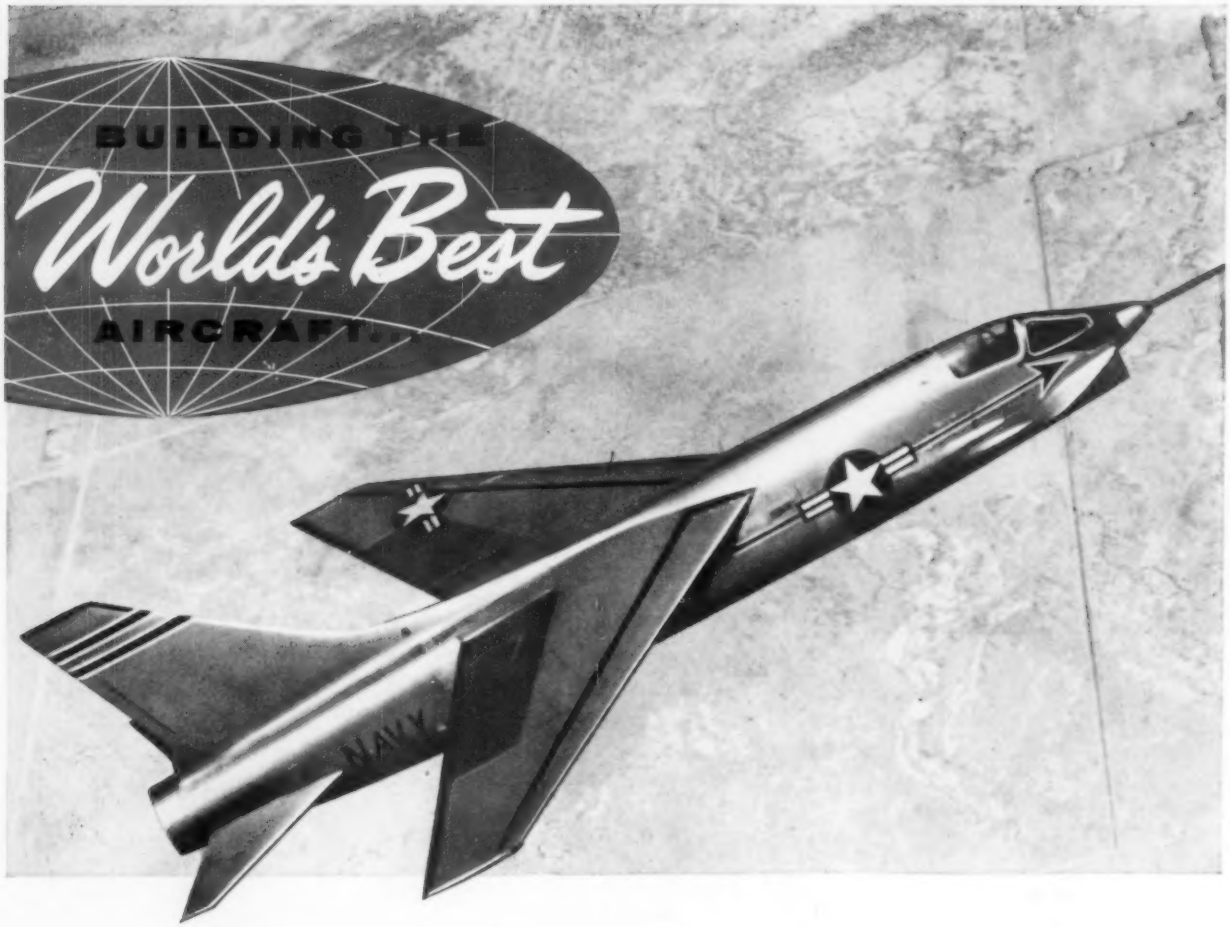

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